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THE

MEDICAL JOURNAL OF AUSTRALIA

EDUCATION NUMBER

VOL. I.—10TH YEAR. SYDNEY: SATURDAY, APRIL 14, 1923. No. 15.

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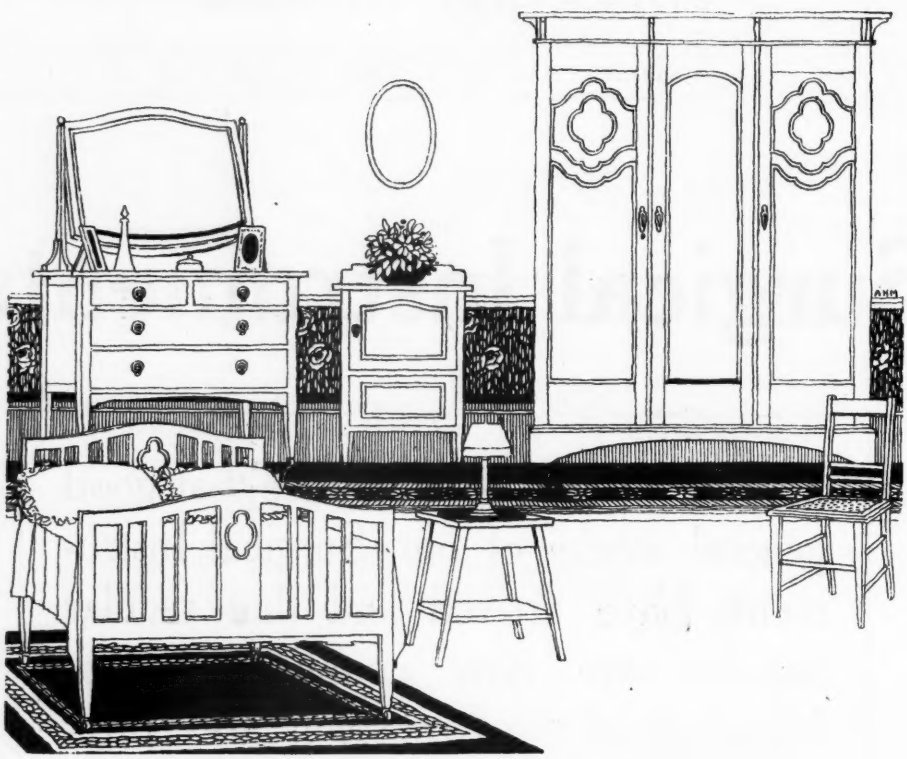

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THE WALTER AND ELIZA HALL INSTITUTE OF RESEARCH IN PATHOLOGY AND MEDICINE, MELBOURNE.

BY S. W. PATTERSON, M.D., B.S. (MELB.), D.SC. (LOND.), *Director of the Institute.*

Initiation.

IN 1912 a movement to improve the clinical pathological work of the Melbourne Hospital was commenced by the medical staff and has led by slow development to the establishment of an institute for research in pathology and medicine, situated in the Hospital grounds.

At the time of the rebuilding of the Hospital it was felt by the members of the medical staff that it was due to the Hospital and their patients that, in addition to the ordinary work of the department of pathology, a man trained in the newer work of clinical physiology and pathology should be appointed to assist in the elucidation of the problems presented daily in practice. It was resolved to set aside from the fund received from the clinical fees of students attending the hospital, a sum for the salary of such a man; the late Dr. G. C. M. Mathison, who was at the time engaged in post-graduate research work at the Lister Institute and at University College, London, was invited to take the position.

Dr. Mathison arrived in Melbourne towards the end of 1913 and busied himself with preparing plans for the building of the new Pathological Block of the Hospital. It was found, however, that in the original scheme no provision had been made for the purchase of apparatus, for maintenance and for the payment of assistants for Dr. Mathison.

A number of medical men, therefore, interested themselves in obtaining subscribers to a clinical research fund which was intended to be used for this purpose. The outbreak of war prevented any further development of the plans.

The Institute.

At the instance of Professor Sir Harry Allen, Honorary Pathologist to the Hospital, the Trustees of the estate of the late Walter and Eliza Hall set aside an annual sum of £2,500 for the purposes of medical research. Through this endowment a third floor and basement with animal houses were added to the new Pathological Block of the Hospital and permanent fittings were placed in the buildings to make the laboratories suitable for all modern pathological requirements.

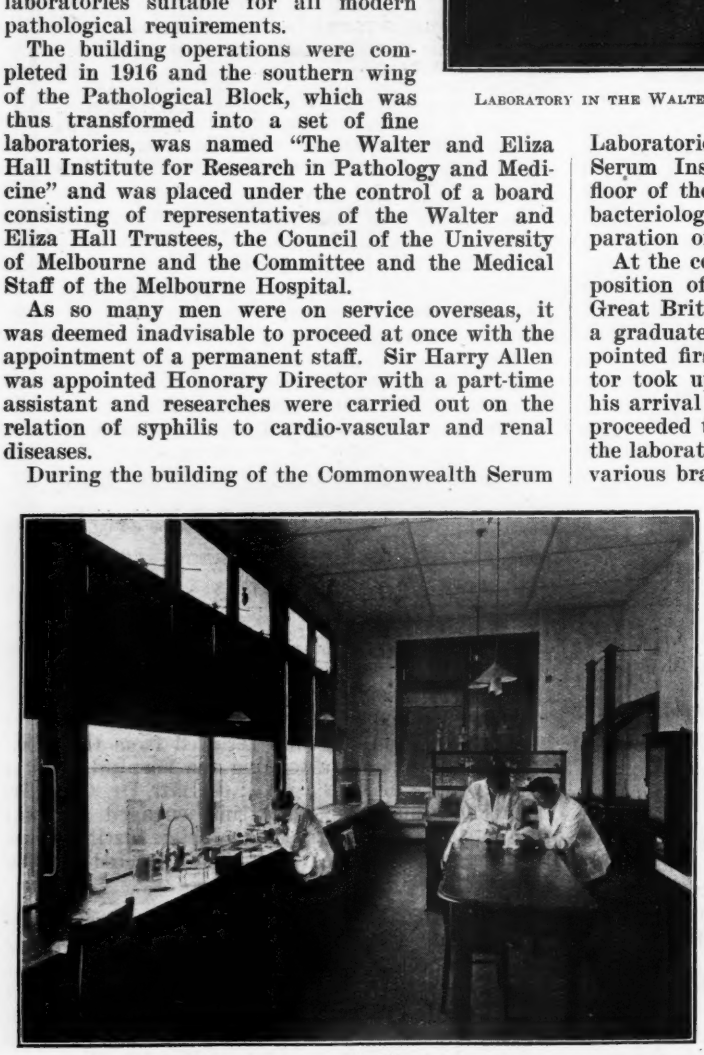
The building operations were completed in 1916 and the southern wing of the Pathological Block, which was thus transformed into a set of fine laboratories, was named "The Walter and Eliza Hall Institute for Research in Pathology and Medicine" and was placed under the control of a board consisting of representatives of the Walter and Eliza Hall Trustees, the Council of the University of Melbourne and the Committee and the Medical Staff of the Melbourne Hospital.

As so many men were on service overseas, it was deemed inadvisable to proceed at once with the appointment of a permanent staff. Sir Harry Allen was appointed Honorary Director with a part-time assistant and researches were carried out on the relation of syphilis to cardio-vascular and renal diseases.

During the building of the Commonwealth Serum Laboratories, the Director of the Commonwealth Serum Institute and his staff occupied the top floor of the Institute, which had been fitted up as bacteriological laboratories; and there the preparation of vaccines and sera was commenced.

Laboratory in the Walter and Eliza Hall Institute of Research.

At the conclusion of the war applications for the position of Director were called for in Australia, Great Britain and America. Dr. S. W. Patterson, a graduate of the Melbourne Univeresity, was appointed first Director of the Institute. The Director took up duty in the Institute immediately on his arrival from London in December, 1919, and he proceeded to collect a permanent staff and to equip the laboratories with the apparatus required for the various branches of pathological work, the bulk of which he had ordered while in England. Considerable delay was occasioned by the post-war difficulties in supplies; but these have now been overcome and the Institute has fully equipped departments of bacteriology and serology, bio-chemistry, morbid anatomy and experimental pathology.



Laboratory in the Walter and Eliza Hall Institute of Research.

Scope of the Work.

Under the deed of trust governing the conduct of the Institute, it is laid down that, while research is to be kept as the principal object of the Institute, assistance is to be afforded as far as possible to the medical staff of the Hospital in *post mortem* work and clinical pathology. The two resident clinical pathologists of the Hospital work in laboratories in the Institute, under the supervision of the Director of the Institute. Small ward laboratories were fitted up in each medical unit, in two of the surgical units and in the out-patient department of the

Hospital, where the resident medical officers and the clinical clerks can carry out the simpler microscopical and chemical tests of blood, sputum, urine and gastric contents. Thus the resident pathologists are freed from a large amount of the routine examinations necessary for the records and case sheets and devote themselves to more intricate bacteriological and chemical work. They also have time and opportunity for carrying out research work on these lines and already several good pieces of work have been done by men during their tenure of these offices.

The close proximity of the Institute to the Hospital is not only of great advantage in giving access for the observation of patients and in the supply of material for investigation and research, but the staff of the Institute are also available to cooperate with the honorary physicians and surgeons in carrying out special investigations of problems and in helping to elucidate obscure cases.

Laboratory in the Walter and Eliza Hall Institute of Research.

Teaching.

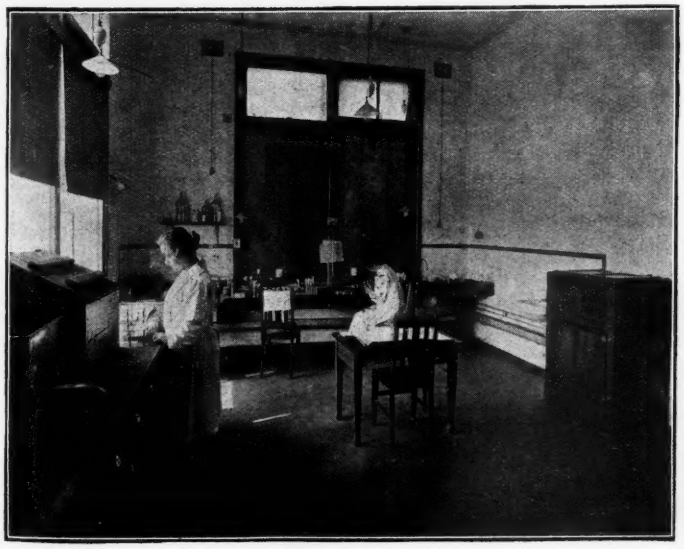
A certain amount of teaching is undertaken. The Director and his staff give a series of weekly lecture-demonstrations on clinical chemistry, bacteriology and blood work to the fifth-year medical students of the University during the first and second terms and tutorial classes in clinical pathology and *post mortem* work are arranged for the fourth-year students when they first come to the Hospital. A pathological museum containing several hundred macroscopic and microscopic specimens arranged anatomically is housed in the Institute and is available for tutorial clinical demonstrations and for individual study. These preparations, preserved in natural colours under the supervision of Mr. H. R. Dew, F.R.C.S., form a valuable addition to the work of the Melbourne Hospital Clinical School.

The staff of the Institute are also available for teaching in the annual post-graduate courses held in Melbourne.

Researches.

But the primary object of research is kept in the forefront of the Institute's operations and a considerable volume of new work has been produced.

The Director has endeavoured to foster "team-work" in research and to coordinate the efforts of several workers engaged on different aspects of the numerous problems dealt with. The propinquity of the Institute to the wards of a large general hospital has naturally directed attention to bringing new and improved methods to bear on the study of disease, especially as it occurs in southern Australia; but interesting side-lines of more academic research have been followed up, often with good results.



Laboratory in the Walter and Eliza Hall Institute of Research.

The study of diseases of the respiratory tract which occur in Australia, has been pursued with considerable success. Investigations have been carried out on the pathology and morbid anatomy of influenza and the occurrence of *Bacillus pfeifferi* in epidemics of influenza, on the type of pneumococci found in lobar pneumonia and the influence of specific anti-pneumococcal serum treatment on the prognosis of pneumonia and on syphilitic affections of the lungs. At present a collective investigation of the incidence of healed and open tuberculosis in the hospital population is being

made, which will form part of the statistics of tuberculosis to be placed before the Australasian Medical Congress (British Medical Association), 1923.

The laboratory diagnosis of hydatid disease has been reviewed in the light of recent work. The complement-fixation test has been elaborated and made a routine laboratory procedure and its results compared with those obtained with the precipitin reaction and with the intradermal skin test. Papers have been published on the development of the brood capsules and scolices in the life history of *Tænia echinococcus*; and reviews of cases of pulmonary hydatid, hydatid of the peritoneum and hydatid of the liver have been made.

The causation of summer diarrhœa and dysentery has been a subject of inquiry and the types of dysentery bacilli found have been grouped. A polyvalent anti-dysentery serum prepared at the Commonwealth Serum Laboratories from strains isolated in this Institute is now available and its efficacy in the treatment of summer diarrhœal affections is being tested. Papers have also been published on the pathology of amœbic and bacillary dysentery and on the bacteriology and serology of a type of dysentery bacillus not previously described in Australia. With the cooperation of bacteriologists in other States, a collective investigation is being made of the races of the Flexner type of dysentery bacilli prevalent in Australia.

Observations on improved methods of carrying out the Wassermann test and the complement-fixation test for gonorrhœa have been made.

Studies have also been made on the pathology and morbid anatomy of malaria and bilharziosis and on cancer of the lip, renal tumours, cerebral tumours, tumours of the testis and on exophthalmic goître.

Among other investigations made are those on the chemical pathology of hepatic and renal diseases and diabetes; on gastric and pancreatic disease and on the basal metabolism in diseases of the endocrine glands.

Staff.

The staff of the Institute consists at present of the Director and four qualified assistants, one of whom is a trained bio-chemist. There are two highly trained technical assistants, one for morbid anatomy and histology and the other in charge of bacteriological preparation.

Two whole-time University Research Scholars reside in the Melbourne Hospital and work in the Institute under the supervision of the Director. The salary of one of these, the Clinical Research Scholar, is drawn from the Clinical Research Fund mentioned above, supplemented by a grant from the University Medical Research Fund. The other is the John Grice Cancer Research Scholar, whose salary is provided from an endowment made for this purpose by Sir John Grice, augmented by a grant from the Government of Victoria. His duties are the investigation of cancer problems, with material obtained from patients at the Melbourne and Austin Hospitals.

In addition, the laboratories are open for research by whole or part-time voluntary workers; apparatus and materials of the Institute are available for use in researches carried out under the supervision of the Director. Numerous medical and science graduates have availed themselves of these facilities and much creditable work has been done.

Relation of the Institute to Practitioners.

Routine pathological investigations for medical practitioners are not made, but specimens having to do with the researches going on in the Institute are welcomed. Where these specimens are from paying patients, any fees sent in are placed to the credit of the apparatus fund of the Institute.

The Outlook.

The Director and the present First Assistant are members of the honorary medical and surgical out-patient staffs of the Hospital respectively and are thus enabled to keep in touch with and continue investigations on patients attending the Hospital.

Modern clinical and pathological research, however, necessitates the closest cooperation between ward and laboratory and frequently several workers are required to carry out the complete chemical or bacteriological investigation of one patient.

The wards or out-patient department of a busy general hospital are not suitable for the continued close observation of patients under the exactly controlled conditions necessary for research. It is hoped that, should the Hospital buildings be increased, a special research ward containing ten or twelve beds will be made available, where particular diseases may be more thoroughly investigated and the effects of treatment more closely watched. In this way progress would be made most effectively in building up a body of scientific experience which will be available for the guidance of medical practitioners and for the enlargement of the boundaries of knowledge of pathology and medicine.

THE COMMONWEALTH SERUM LABORATORIES.

By W. J. Penfold, M.B., B.Hy.,
Director, Commonwealth Serum Laboratories, Royal Park, Victoria.

The Commonwealth Serum Laboratories were established primarily to supply the needs of Australia in respect of biological preparations. To do this work effectively a highly trained staff was required, which would be in a position to investigate all the different factors that determine the production of active biological agents. During the developmental work of the Laboratories the training of such a staff was the first consideration. In the development of the institution the work has been divided and subdivided, so that at the present moment eleven departments exist within the Laboratories.

The laboratory of first importance probably is that in which the personnel for the country laboratories throughout Australia has been and is being trained. This is essentially a department to provide facilities for education in bacteriological and clinical diagnosis work and when the laboratory service of Australia is fully developed and manned, the far-reaching influence of the work of this department will reveal itself.

The personnel for these country laboratories has been trained in routine investigational work, but up to the present no member of the laboratory service has been set apart entirely for research into the causation or control of disease as it exists in Australia. This training department has specially provided for its use in the new wing one large room to accommodate at least six post-graduate students and one room for the bacteriological tutor who will supervise the work of these post-graduates. It is hoped that this department may develope as a training ground for other workers in medical and industrial bacteriology; for facilities for such training are at the present time singularly poor within the Commonwealth.

A serum department exists in which the production of toxins and other bacterial antigens, the immunization of horses, the collection of normal and specific sera and the titration of specific sera are undertaken. In this department from time to time experimental sera have been made on a large scale, for the treatment of gonococcal, staphylococcal and other infections, with a view to elucidating the value of the respective sera. Such a serum was made for the use of Dr. Allan Walker in the treatment of the complications of gonorrhœa.

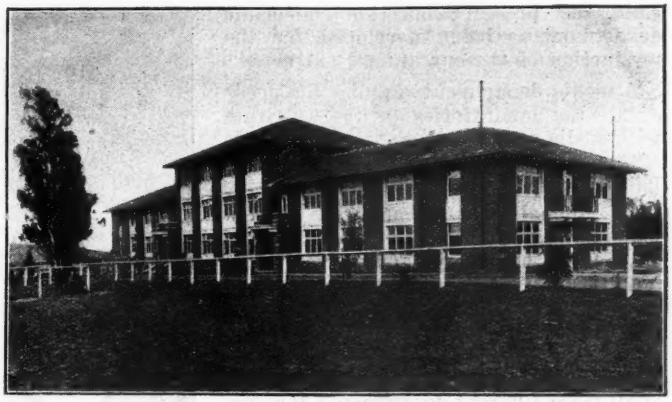


Figure I..
Commonwealth Serum Laboratories: General View of Buildings.

In the killed vaccine laboratory all the ordinary vaccines used in the prophylaxis and treatment of disease are prepared. This involves a large amount of work in the identification of strains and the constant supervision of extensive literature, so that all the modern improvements in vaccine production may be availed of in the work.

In the bio-chemical laboratory the concentration of anti-diphtheritic and anti-tetanic sera is carried out and any bio-chemical problems which arise in the course of the work of the other sections of the laboratories, are elucidated.

The tuberculin department exists for the production of tuberculin, for the investigation of tuberculous material from general and children's hospitals and from animal sources. In this department also cognizance is taken of other acid-fast organisms which have the power to produce disease.

In the Jennerian lymph department vaccine lymph is prepared in large quantity, so that in the event of a small-pox epidemic a sufficient amount of active lymph will be at the disposal of the health authorities.

In the diagnosis department the isolation and identification of strains from cases of disease in both man and animals are undertaken. In the same section many useful diagnostic agents are produced.

In the Directors' department the Australian pneumococci have been fully classified and anti-pneumococcal serum for the treatment of lobar pneumonia and post-influenzal pneumonia serum have been produced, both of which sera have been of very definite value in treatment.

In the veterinary department some research work on pleuro-pneumonia has been undertaken. Large quantities of prophylactic agents against contagious abortion and contagious mammitis and small quantities against swine plague have been produced and very gratifying reports have been received from the clinicians using these preparations.

Figure II..
Commonwealth Serum Laboratories: Concentration Room, Bio-Chemical Laboratory, showing the copper baths in which the serum is heated, and the filter funnels in which the first precipitate is collected.

At the present time an endocrinic department is being developed for the production of various animal extracts.

A media department supplies the needs of all the laboratories of the Institute with media and also those of a large circle of bacteriological workers outside the Laboratories.

An animal department, well stocked with horses, guinea-pigs, rabbits, rats, mice and other species, offers unrivalled facilities in Australia for the production on either a small or large scale of sera for therapeutic, diagnostic or other scientific purposes.

It is essential to mention the existence of all these different departments, for they constitute in themselves excellent facilities for the young bacteriological worker who would acquaint himself with the present position of innumerable problems in bacteriology.

Figure III..
Commonwealth Serum Laboratories: Bleeding one of the Horses.

Although no central research staff has been appointed at the Institute, a large amount of research work has been undertaken in the production of important biological preparations.

Three salaried medical officers exist at present on the staff of the Institute: Dr. W. J. Penfold, Director of the Division of Laboratories, assisted in the scientific manufacturing work of institute by Dr. F. G. Morgan and in the educational work of the personnel of country laboratories by Dr. W. C. Sawers.

None of these men are able to give more than a relatively small fraction of their time to academic research, though each of them has much to do in the way of applied research.

The Laboratories have not been privileged to have the services of many voluntary research workers, but Dr. G. M. Heydon, now in Rabaul, commenced his service as a voluntary worker in the Laboratories and was successful in growing various mouth spirochætes and in confirming the importance of symbiosis in their cultivation.

Another voluntary research worker at the present time is endeavouring to elucidate the part played by the tissues in natural immunity. One or two other workers have offered their services to the institute in a voluntary capacity, but they have not been in a position to continue their work for more than a few weeks and consequently have not produced very substantial results. It is greatly to be regretted that so few persons feel called upon to devote their lives and means to the work of research. Australia has not yet been bitten by its fascination.

When we consider that in the South African Institute for Medical Research in Johannesburg £10,000 *per annum* is spent on pure research, while in the Serum Laboratories of Toronto a very large endowment is annually devoted to the same purpose, it is evident that extensions of the work of the Laboratories in this direction are urgently called for.

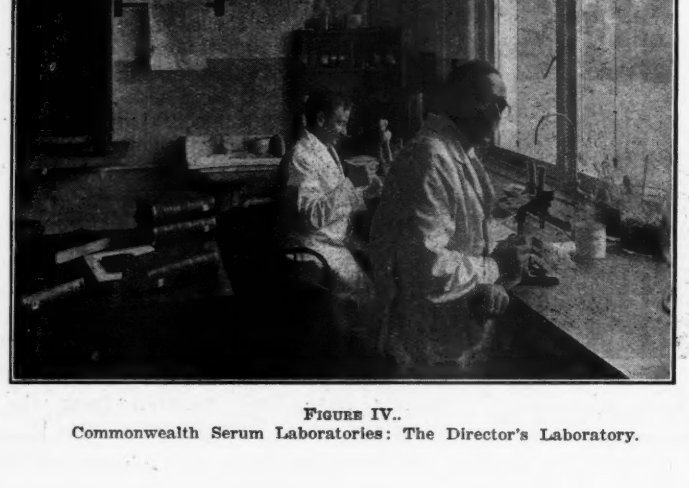


Figure IV..
Commonwealth Serum Laboratories: The Director's Laboratory.

THE AUSTRALIAN INSTITUTE OF TROPICAL MEDICINE.

Compiled by Special Request by the Director-General of Health for the Commonwealth.

The Australian Institute of Tropical Medicine was founded in 1907-1908 as the result of the fusion of a scheme put forward by Professor Anderson Stuart, Dean of the Faculty of Medicine in the

University of Sydney, with a scheme propounded by the Reverend Dr. Frodsham, Bishop of North Queensland, who voiced the generally felt needs of the settlers in the tropical areas.

The support of the Universities of Sydney, Melbourne and Adelaide and the Governments of Queensland and the Commonwealth enabled the suggestion to take definite form and to result in the inauguration of the activities determined on.

A committee of management was appointed, comprising representatives of the Universities of Sydney, Melbourne and Adelaide, the Government of Queensland and the Federal Government.

Advantage was subsequently taken of the presence of Professors Anderson Stuart and Allen in London, where they were attending a congress of Universities of the Empire, to secure the services of the first Director, Dr. A. Breinl, who arrived about the end of the year 1909. In 1911 the Australasian Medical Congress met in Sydney and resolved:

That a report be made to the Federal Government, with a view of securing for the Australian Institute of Tropical Medicine such increases of funds and staff as will enable an organized inquiry to be undertaken without delay into the various matters likely to affect the establishment of a working white race in Tropical Australia.

Substantial extensions of staff and resources were thus secured. During the succeeding years considerable research work was carried out and the programme gradually developed until the outbreak of war in 1914, when larger issues of national importance necessarily overshadowed the lesser.

Figure V..
Commonwealth Serum Laboratories: A Corner of the Library.

Owing to the successive resignations of Doctors Nicoll, Priestley, Young and Breinl, to follow their fortunes in other fields, a temporary lull in the activities of the Institute occurred.

In 1921 the control of the Institute having passed to the Commonwealth Department of Health, under the immediate supervision of Dr. J. S. C. Elkington, a member of the original committee, steps were taken to place the Institute on an active working basis with a policy designed to meet the needs of the tropical areas of Australia and its dependencies.

Certain delay was caused owing to the fact that the officer selected to fill the post of Director, Dr. R. W. Cilento, was at the time in the employ of the Government of the Federated Malay States. On taking up duty, Dr. Cilento proceeded on tour embracing pratically all countries of importance from a tropical point of view, with the intention of gaining by direct observation a thorough acquaintance with the methods of control and prevention of diseases in vogue elsewhere.

Further with a view to observation of the best educational system in practice Dr. Cilento proceeded to the London School of Tropical Medicine and there took out a diploma in medicine and hygiene, gaining at the same time the Duncan Medal as prizeman of his session and subsequently the Lacaca Medal which is awarded to the student obtaining the highest aggregate of marks throughout the whole series of sessions for the corresponding year.

This was the first occasion on which either medal had been gained by a Australian.

The Australian Institute of Tropical Medicine has been refitted internally to provide excellent laboratory and educational facilities. There are now provided general and research laboratories, media rooms, one of the most extensive libraries on tropical and allied subjects in Australia, various special departments including, entomology, protozoology and helminthology sections, a museum of pathological material, special facilities for private research workers and such necessary adjuncts, such as photographic dark room, store rooms and animal houses *et cetera*.

The functions of the Institute fall into three main divisions which may be described as investigational, educational and diagnostic. They may be tabulated in the following way:

The classification and coordination of existing knowledge concerning preventible diseases in tropical Australia and its dependencies.

The application of known principles of epidemiology for the accurate determination of Australian factors in the causation of local preventible diseases.

The collection, recording and classification of all facts relating to—

(*i*) The incidence and causation of disease in the Australian tropics,

(*ii*) The preservation of health amongst white or coloured inhabitants of the Australian tropics,

(*iii*) The biology of animals or insects associated with the incidence of disease or the maintenance of health in man,

(*iv*) The presence of local factors liable to operate in the presence of introduced exotic disease.

Educational courses as may from time to time be arranged.

The dissemination of information relating to the causation and treatment of disease and the maintenance of health in the tropics.

Such functions in connexion with the administration of the *Quarantine Act* as may be necessary.

Clinical and scientific services to the Townsville General Hospital.

The provision for the district around Townsville of the services provided by district health laboratories elsewhere.

Cooperation with State and local health authorities in measures relating to the prevention of disease and the maintenance of health in the tropics.

As a Commonwealth health laboratory the Institute is equipped to deal with practically every aspect of clinical, bacteriological and pathological work. A large stock of the prophylactic and curative vaccines and sera, prepared at the Commonwealth Serum Laboratories, Melbourne, is always on hand.

As part of its objective the Institute has determined to acquaint medical men and others from time to time with the present state of knowledge in regard to diseases of local importane, to encourage practitioners to investigate the diseases and to provide facilities for the classifying, coordinating and explaining of their observations in accordance with accurate scientific methods. It aims further at providing bacteriology, pathology and physiology laboratories which will give to the tropical practitioners the facilities available to the dwellers in the larger cities of the south and it offers to men proceeding to regions more remote as, for example, Papua and Mandated Territories, preliminary and complete courses of education for the prevention, cure and investigation of tropical disease.

Arrangements have been made with the Universities to enable an Australian diploma in tropical medicine, subject to certain conditions, to be granted to medical graduates who are successful in passing satisfactorily an examination at the conclusion of any session's teaching. The teaching arrangement also includes short courses for district officers, managers of plantations, missionaries, sanitary inspectors, medical orderlies and other unqualified persons whose work brings them in contact with large bodies of natives or with conditions of importance from the standpoint of tropical disease. Concurrently with the educational and routine diagnostic work of the Institute research into the numerous unsolved problems of the Australian Tropics is especially continued by trained observers and investigators.

Arrangements have been made by which facilities for private research can be afforded to *bona fide* investigators at the Institute, subject to the exigencies of the service. Bench space will be afforded for the carrying out of an approved programme by voluntary workers with satisfactory qualifications and research workers will be for the time being under the control of the Director and will be regarded as supernumerary medical officers. Materials and services will be provided at the actual cost to the Department.

THE MICRO-BIOLOGICAL LABORATORY IN ITS RELATION TO PROBLEMS OF RESEARCH.

By Eustace W. Ferguson, M.B., Ch.M. (Sydney),
Principal Micro-biologist, Department of Public Health, New South Wales.

The primary function of a public health laboratory is necessarily the investigation of the many problems involved in the protection of the health of the community. Secondly, the facilities of the laboratory are available for the assistance of medical practitioners, country hospitals *et cetera* in the elucidation of individual cases of disease by the examination of specimens which may be submitted to the laboratory.

The lines of research, therefore, in such a laboratory are in the main restricted to investigational work, and it is with this aspect of the subject that I shall principally deal.

Viewed in the broadest aspect the research work of the health laboratory falls into two main groups which are, however, more or less closely related, but which for practical purposes may be considered separately. These two groups may conveniently be termed investigations into specific diseases and hygienic invesigation. I do not contend that this arbitrary classification covers the whole ground of the laboratory's activities in research, but opportunities for research in other avenues may be limited by virtue of want of material or of time on the part of the staff generally overloaded with routine work. Some of these lines will, however, be indicated later.

At this stage it may be well to consider from another aspect the position of the micro-biologist in his relation to research. The laboratory worker can rarely confine his activities to any one branch. Most often he is primarily a bacteriologist, but must in addition combine the rôles of pathologist, protozoologist and helminthologist. It is not contended that the micro-biologist must be a specialist in each one of these subjects, but it is essential that he possess some working knowledge of all. Under the circumstances, his natural bent will be most likely to lead him to research work in the subjects in which he is more especially interested. It was on account of the varied nature of the work that the term micro-biologist was employed as embracing all other designations.

As instances of the nature of the investigations outlined above, which fall within the sphere of work of a public health laboratory, I intend to mention specifically some of the problems that have been

investigated in the Micro-biological Laboratory of the Department of Public Health of New South Wales.

Investigations into Specific Diseases.

Most of the diseases which have called for special investigation, have been in the nature of epidemic disease and in the study of these the laboratory has worked in conjunction with the public health officers charged with control of the outbreak. Team work is here essential and the micro-biologist must be in close touch with the epidemiologist. While it may be contended that much of the work in connexion with such diseases does not come within the scope of research proper, in every outbreak of this class opportunities occur for research into special aspects of the disease or of its causal organism and it is by the summation of the results of such researches that knowledge of a disease is gained.

Since 1913 New South Wales has been visited by three outbreaks of diseases not endemic in this country: small-pox in 1913-1917, influenza in 1918-1919 and bubonic plague in 1921-1922.

The small pox outbreak was of a mild character and raised the question here, as in other parts of the world, as to whether the outbreak was a modified form of the virulent disease or a separate entity, allied to if not identical with *alastrim* in South America and *amaas* in South Africa. Research into this question was undertaken at this laboratory, though no material from virulent small pox or *alastrim* being available, the inquiry had to be restricted to cross immunity vaccination experiments between the Australian disease and vaccinia. The results though inconclusive tended to show that some relation did exist between the two conditions.

In the influenza epidemic this laboratory in common with other laboratories all over the world wherever the pandemic made its appearance, endeavoured to discover the ætiological agent responsible for the disease. The bacteriological examination of sputum, tissues *et cetera* and the isolation and identification of the organisms present involved an immense amount of work. Though the claim of any specific organism to be the infective agent was not established, the researches then carried on in so many laboratories have led to a better knowledge of the flora of the lungs in cases of pneumonia and to a large extent the recent researches on the pneumococci have followed on work done during the influenza epidemic.

It would be difficult in a discussion on the investigations into epidemic diseases to avoid a mention of the outbreaks of bubonic plague which occurred during the period of ten years from 1900 to 1910 and later in 1921 and 1922. At the time of the earlier outbreak comparatively little was known of the mode of spread of the disease and the epidemiological and laboratory work of this department did much to clear the ground of misconceptions and point to the rat flea as the probable vector of the plague bacillus from rat to man.

In the 1921-1922 outbreak conditions were different, the ætiology of the disease was firmly established and the mode of transmission known. Investigational work was, therefore, more or less along routine lines. The subject of the distribution in Australia of the rat flea still calls for further elucidation and inquiries on this question are now being pursued.

These instances suffice to illustrate the nature of the researches that can be undertaken by public health laboratory in times of epidemic disease. Two other outbreaks may, however, be mentioned, as in both extensive investigations were carried out into the ætiology of the diseases concerned.

In 1916 an outbreak of dengue fever in Queensland and the northern rivers in New South Wales gave an opportunity for discovering the vector of this disease. The results of the researches carried out by Drs. Cleland, Bradley and McDonald proved beyond question that at any rate in Australia the vector is the well-known tiger mosquito (*Stegomyia fasciata*), which is also the vector of yellow fever. These investigators were able to bring infected mosquitoes from the northern rivers down to Sydney and to infect volunteers here. Their work was the more convincing by reason of the fact that dengue never occurs endemically in Sydney, nor does the tiger mosquito extend so far south.

Again in 1917-1918 an outbreak of an obscure form of polio-encephalitis appeared in the outback towns in New South Wales and Queensland. The clinical manifestations of this disease, conveniently termed "X disease," pathology and histology were closely studied by Dr. Cleland, in conjunction with Dr. Campbell and Dr. Bradley, and animal inoculation experiments carried out. The nature of this outbreak is still open to question, but the work done by these investigators has largely contributed to a more exact knowledge of the disease.

Hygienic Investigations.

These may also be in great measure of the nature of routine examinations and it is doubtful whether a sharp line can always be drawn between routine examination and research in this field. The daily examination of milk samples, for instance, may be a routine procedure, but may at the same time be portion of a research into one or other of the many problems in connexion with the milk supply. I have used this as an illustration, as one of the most important investigations now being pursued at this laboratory is an inquiry into the bacterial content of the Sydney milk supply.

The demand for the production of a good, clean and reasonably cheap milk supply is becoming more insistent and public opinion is now backing up the health authorities in their task of endeavouring to improve the supply. In England and America bacterial standards, varying according to local conditions, grade of milk and so forth, have been instituted and the present inquiry is directed towards the question of the establishment of a standard for

the Sydney supply. Such an inquiry has, of course, many different aspects. It is necessary to know the bacterial content under present conditions, whether it varies with the seasons, what variations are due to climatic conditions, the source of bacterial contaminations, what alterations should be made in the handling of the milk and in what stage of the transit.

These and like problems are to a large extent dependent upon careful bacteriological examinations comprising both lengthy series of examinations of the milk as delivered to consumers and the examination of samples taken at varying stages in the transit from producer to consumer. This work is, of course, not original; it has been undertaken in most countries which have concerned themselves with the production of a good milk supply, but in view of the different conditions it requires to be done locally before the institution of a bacterial standard can be attempted.

Shell-fish, particularly oysters, may be concerned in the propagation of disease, especially of typhoid fever. As a general rule oysters from localities subject to night soil or sewage pollution are regarded as suspect and are prohibited from sale. The question arises, however, as to what should be considered as evidence of pollution, whether a high bacterial count affords any indication, or whether the presence of certain organisms such as *Bacillus coli* or *Bacillus sporogenes* can be adopted as the test of pollution. Work on these lines is now proceeding at the laboratory.

The occurrence of cases of anthrax due to infection acquired from shaving brushes has led to extensive investigations into the subject of shaving brush infection. Unfortunately infected brushes are not confined to any one particular make, as over a dozen different infected brands have been found in New South Wales; it is improbable that all of the infected brands have been traced. Experiments have also been carried out into the best methods of sterilizing shaving brushes.

Under hygienic investigations might also be grouped the inquiries that have to be made from time to time into outbreaks of food poisoning. The detection of the causal organism is purely a bacteriological undertaking and in tracing the source of infection the bacteriologist may greatly assist the efforts of the epidemiologist, either in confirming his findings or in indicating the true source of infection.

Furthermore, it is out of such invesigations that the now extensive researches into the organisms of the food poisoning group have arisen.

Bacteriological Researches.

For the undertaking of researches along pure bacteriological lines a public health laboratory is perhaps not well suited. Material is often available and opportunities present themselves for the investigations of possibly new types of organisms or for the study of imperfectly known bacteria, but too often it happens that at the time there is a press of other work on hand and no officer can be detached to devote his time and attention to the matter. Another serious disadvantage to research work in such a laboratory is that carefully planned investigations extending over a long period may be disrupted and rendered useless after several months of arduous work by the whole resources of the laboratory having suddenly to be concentrated on emergency work arising from a wide-spread epidemic or an outbreak of some dangerous infectious disease.

Where possible work of this nature is undertaken, but it is subject to the limitations outlined above and with the increase of routine work it has become increasingly difficult to attempt original research unless as portion of a problem requiring investigation from the public health aspect.

Much more work might also be done in the analysis of the results of the routine examinations, while a wealth of pathological material, including many tumours of diverse type and sometimes of great rarity, passes through the laboratory and might well repay a closer study than is attempted in the routine interpretation and diagnosis. Certain work in this direction has been attempted. The results for instance of the treatment by autogenous vaccines have been collected for several years and summarized. Also one or two studies have been published on pathological tissues, as for example the work of Dr. Cleland and Dr. Paul on rodent ulcers.

Entomological Researches.

The dependence of many diseases on insects for their transmission requires on the part of the hygienist some knowledge of the insects concerned and of their life history and distribution. Inasmuch as the life histories of many groups of Australian insects are very imperfectly known, a vast field for research is opened up for the medical entomologist. It is a commonplace remark that all our Australian pests are imported; this may be in a measure true of the common house fly and of the rat flea, but many other pests, as for example our mosquitoes, are certainly indigenous to this country. Furthermore, it remains to be seen in many instances whether Australian species are capable of acting as hosts of the parasites of imported diseases. There are also certain endemic diseases in tropical Australia which in all probability depend for their transmission on native species of insects. For these reasons this laboratory has been gradually compiling a collection of Australian and introduced insects of medical interest and accumulating information as to their geographical distribution and seasonal incidence.

Research by Workers Not Attached to the Staff.

Little has been done to encourage medical men to undertake research work in this laboratory. This has not been on account of any objection to affording such workers any facilities they may require, but solely on account of the limited accommodation available. Furthermore, the distance from any sources of clinical material, such as one of the large general hospitals, is a distinct drawback.

Twenty-five years ago the department secured the adjacent block of land for extension of its congested space. Plans have been drawn and redrawn for a building which would provide working space commensurate with the demands made upon the laboratory, but Parliament after Parliament has failed to provide funds for extension of the building and the ideal laboratory remains a pigeon-holed plan, while work has to be carried on under dangerous conditions in overcrowded and ill-ventilated rooms. For this reason it has not been found possible to undertake systematic instructional work either for medical officers or students in this all important branch of preventive medicine.

BACTERIOLOGICAL LABORATORY OF THE UNIVERSITY OF MELBOURNE.

By R. J. Bull, M.D., B.S.,
Director of the Bacteriological Laboratory.

The activities of the Melbourne University Bacteriological Department are mainly of a two-fold character. Academically it is primarily devoted to teaching and research. But the growing requirements of public health have become so pressing that at the present time it also subserves the purpose of a public health laboratory. Starting in a small way just twenty-five years ago with a Government grant of £150 donated for the purpose of research in matters relating to public health, this off-shoot of the Pathology School became an independent department in 1900, with separate buildings, equipment and staff. The pressure of routine work is indicated by the examination figures for last year, totalling upwards of 35,000 health specimens, including nearly 15,000 Wassermann tests. These results are exclusive of routine examinations of the milk and water supply of the Metropolis and other important investigations. Obviously with a very small and limited staff, research must suffer to some extent in proportion to the increasing demands of routine work. This handicap notwithstanding, much valuable work continues to be done in this direction.

Before dealing with the facilities provided for research and the provisions made for practitioners desiring to acquire laboratory technique or to conduct private research, it may be opportune to indicate the scope of the teaching and opportunities for correlated research by briefly summarizing the classes conducted.

Routine Classes.

The routine classes include medical bacteriology (medical curriculum), dental bacteriology, agricultural bacteriology, economic bacteriology, and bacteriology and parasitology (Diploma of Public Health).

Occasional Classes.

Occasional classes are held in connexion with post-graduate work, dairy bacteriology and the University extension work. During the war special classes were organized for members of the Sanitary Corps and a great deal of routine work and research was undertaken on behalf of the Defence Department.

Also, prior to the foundation of the Veterinary School, all research and investigations of animal diseases on behalf of the Department of Agriculture were undertaken in the Bacteriological Laboratory and for a time veterinary students attended special classes.

Facilities for Research.

The field of selection offers endless possibilities to research students, particularly as so many medical problems assume a wider outlook when opportunities are available for a simultaneous study of comparative pathology and economic aspects in relation thereto.

Unfortunately, although the laboratory rooms are commodious, well lighted and suitably equipped and excellent animal houses are provided, only a very limited number of research students can be accommodated until some relief is forthcoming in the matter of routine work and until necessary building extensions are provided and additional staff made available. At present the laboratory is able to cater for two or three research workers or others desiring to acquire laboratory technique, but only at such times when class and routine work allow of this being done. A small fee is usually charged for materials and reagents. Fewer practitioners present themselves than previously, probably owing to conditions of life and greater competition, allowing less time to those interested in research.

To the Bacteriological Department of the Melbourne University is due the credit of inaugurating the first post-graudate classes for medical practitioners in Victoria. These classes were arranged and always well attended, especially when some new development of clinical bacteriology necessitated a deviation from the routine, as for example the discovery and application of precipitins, opsonins, new uses for tuberculin and the relationship of anaphylaxis, autogenous vaccine therapy, the discovery of the *Spironema pallida* and complement fixation tests.

Latterly, since the larger hospitals have taken charge of the post-graduate curriculum, most of the clinical bacteriological classes have as a natural sequence drifted to the hospital laboratories. Meanwhile, the laboratory is always available for these classes, if a sufficient number of practitioners signify a desire to undertake the work.

Since its inception the members of the staff of the laboratory have always taken an active part in research. A commencement was made in 1898 when the differentiation of acid-fast bacilli in urine was established upon a practical basis, followed shortly after by prolonged investigations as to the differentiation of the typhoid-coli group and their detection in water supplies. Early work on indigenous lactic acid cultures led to their use for the first time in Victorian butter and cheese factories.

A prominent part was also taken in the early work on the mechanism of the toxin-antitoxin reaction in diphtheria.

It was the facilities provided for individual research which enabled Dr. Konrad Hiller in undertaking a study of blood diseases, to lay the foundation of the Wassermann test in Victoria.

Pioneer work has also been done in the important problems of "germ-carriers."

Immunity and immunity reactions have always provided material for research and attention has also been given to many of the factors relating to malignant disease.

Considerable research work has been undertaken in reference to animal diseases, particularly from the point of view of comparative pathology and for economic reasons. The earlier researches established the ætiology of a widespread disease in Australian sheep (cheesy lymphatic glands) and cultures handed to Professor Nocard were identified by him as the causative factor in a disease of European horses he had investigated.

Experimental work has also been carried out on other animal diseases, including tuberculosis, swine fever, pleuro-pneumonia and investigations of filtrable viruses.

THE PATHOLOGICAL DEPARTMENT OF THE UNIVERSITY OF ADELAIDE AND THE SOUTH AUSTRALIAN GOVERNMENT LABORATORY OF PATHOLOGY AND BACTERIOLOGY.

By J. Burton Cleland, M.D., Ch.M. (Sydney),
Professor of Pathology, University of Adelaide;
and
L. B. Bull, D.V.Sc.,
Deputy Director, South Australian Government Laboratory of Pathology and Bacteriology.

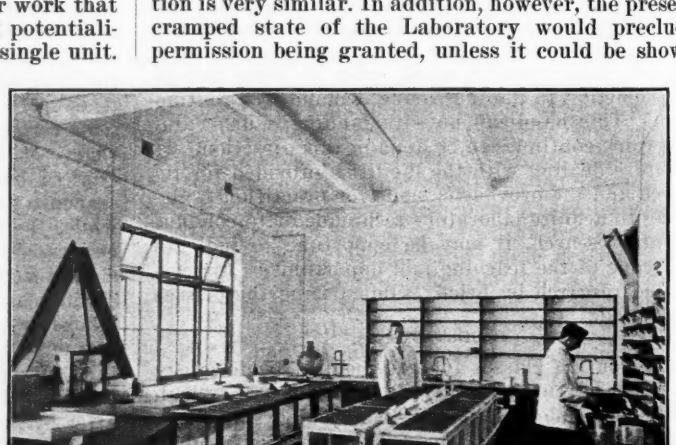
The Pathological Department of the University of Adelaide and the South Australian Government Laboratory of Pathology and Bacteriology are so closely associated with each other in their work that it is advisable from the point of view of potentialities and activities to consider them as a single unit.

The University Laboratory is situated in the new Darling Building. The Government Laboratory is located in the Adelaide Hospital grounds and is under the control of the Board of Management of the Adelaide Hospital, though in its establishment it was not an integral part of that institution.

The former Laboratory which has only been occupied for a period of a year, provides ample accommodation for the present number of students as well as room for investigations of a research nature, though its equipment for the latter purpose is still incomplete. The Government Laboratory, on the other hand, owing to the rapid increase of pathological and bacteriological work, is now severely handicapped through lack of space. Plans for enlargement have been approved, but as yet the additions have not been started. The staffs of both institutions, though adequate for the purpose of teaching students and for the carrying out of the ordinary investigations of individual pathological conditions, are not sufficiently large to enable officers to be detached wholly from their ordinary duties for the purpose of undertaking special investigations requiring the expenditure of a great deal of time. In view, however, of the importance that must be attached to senior officers themselves conducting research—a form of mental recreation which is in the end absolutely necessary to enable them to carry out teaching duties and routine pathological examinations with success—every opportunity for advancing medical knowledge that has presented itself to members of these staffs, has been followed up as far as possible.

The University authorities also recognize that it is necessary that their senior officers should carry out research work. They further realize that research work by others should, as far as possible, be facilitated by the University in every way. They consider, however, that apart from the question of the investigator being fully qualified for undertaking the particular line of research he contemplates, it is necessary that his presence in the Laboratory should not interfere in any way with the teaching requirements of the Department or the research work being carried out by members of the staff. Any applicant, therefore, for permission to work in this department would require to have his case judged on its merits and would have to submit to his request being declined, on such unstated grounds as those of personal incompatability, of interference with routine requirements or for other reasons. Arrangements would have to be made by the proposer for funds to cover any extra expense necessitated by the purchase of apparatus, reagents and experimental animals.

As regards the Government Laboratory the position is very similar. In addition, however, the present cramped state of the Laboratory would preclude permission being granted, unless it could be shown



The Darling Building: Advanced Physiology Laboratory.

that the subject to be investigated was one requiring urgent attention and that the prospects of some success were reasonable. Under such circumstances the Board of Management would give full consideration to the case of the applicant.

Facilities Provided in the Laboratories for Research.

As regards the University Laboratory, space is at present available for research, including a special room, at present occupied by Dr. Beare in carrying out his work on gastro-enteritis in infants on behalf of the Gastro-Enteritis Research Fund. The University, at present, has no funds ear-marked for medical research other than the above. Portion of a recent bequest may, however, be so devoted. The staff of the department would grant all possible assistance and advice.

As regards the Government Laboratory, apart from the lack of room the facilities for research exist, though funds would be required for apparatus and the like, unless circumstances were such as to warrant the Board of Management and the Government in arranging for the extra requirements.

Provision made for Practitioners Desiring to Acquire Laboratory Technique.

Lack of staff and the pressure of their ordinary duties prevent either Laboratory from offering an open door to practitioners desiring to acquire laboratory technique. Individual cases would be considered on their merits, particularly from the point of view of non-interference with the work of the respective staffs. As far as possible, every facility would be given in individual cases to suitable applicants.

Facilities to Those Desiring to Engage in Private Research

The remarks in the preceding paragraphs cover this aspect. In addition, however, it is recognized that a person carrying out research work is attempting to add to the sum of human knowledge to the advantage of the community, the laboratory and the hospital. Manifestly, therefore, special efforts would be made by the University to grant facilities to suitable persons for this purpose, in which as far as possible the Board of Management of the Adelaide Hospital would cooperate.

PHYSIOLOGICAL LABORATORIES OF THE UNIVERSITY OF SYDNEY.

By H. G. Chapman, M.D., B.S.,
Professor of Physiology.

Accommodation.

When he designed the Medical School of the University of Sydney, Sir Thomas Anderson Stuart made provision for three laboratories for research in the Department of Physiology. In the medical building, completed in 1887, there were a chemical laboratory, an experimental laboratory and a histological laboratory. These rooms were used for investigations in physiology and bio-chemistry for twenty-five years. In 1910 a new physiological department was built with provision for research in pharmacology, bio-chemistry and experimental physiology. In the plan a group of five rooms was placed for chemical investigations. These rooms consisted of two rooms equipped for general work, with slate and wooden benches, a group of ovens and water baths, fume chambers and tables comparatively free from vibration. A third room was provided for routine operations and a balance room and dark room were easily available. These rooms were fitted with tables on brackets in the heavy stone walls. Another group of five rooms served for bio-physical investigations. They were provided with tables supported on brick columns and free from the floor or placed on heavy iron brackets on the walls. One room was provided for gas analysis, another for photographic or dark-room purposes, and a third for special psychological study. These eleven rooms now form the research rooms of the department, with the addition of a room for histological and microscopical investigations. The research rooms lie in the north-eastern angle of the present Medical School and form the right-hand side of what will be the front of the completed medical building. These rooms can readily house twenty investigators, as they are of ample size and contain over two hundred feet of bench space.

Equipment.

The original experimental laboratory was furnished with power provided by a large water motor, with a kymograph, with an artificial respiration pump, with a large myograph and with a reliable clock fitted with an electrical device for chronographic records. The apparatus was fitted with various improved mechanical contrivances by different persons using them. Anderson Stuart exhibited his genius in a writing point later adopted in most British laboratories; Almroth Wright gave attention to the exactness of the measurements and C. J. Martin added homely arrangements possessed of a high degree of efficiency. The research laboratories have benefited by the years of patient work by the staff. Little money has been spent in buying perfected instruments, but these have been supplied by the labour of the staff. In 1887 a workshop with a good lathe, plane, drill and general outfit was provided. Most of the instruments and recording gear in the museum and working rooms, together with the class apparatus, have been made in the departmental workshop. To Messrs. J. Shewan, Masters and G. Williams is due the mechanical skill which put into effect the designs of the members of the staff. In his early years in Sydney, Anderson Stuart devoted his spare hours to the design of good mechanical instruments for use in physiological laboratories. A recording cylinder, a manometer and tambours may be mentioned. Of the work of Almroth Wright, little remains. He commenced in Sydney his experiments on methods of measuring minute amounts of fluids without standard units, but none of his actual apparatus has survived. Some preparations of nucleo-proteins were made by him and have been stored in the departmental museum. C. J. Martin left abundant evidence of his varied activities. The filter for separ-

ating large and small molecules, used in the classic experiments for determining the chemical nature of the antagonism of antibody and toxin, is the most noteworthy. As a result of the work of these and other members of the staff there is much tested equipment and apparatus available for various types of research work. In the last fifteen years there has been a large addition in this direction. The workshop has received a watchmaker's lathe and a complete gear-cutting high-class lathe. A hack saw, a burnisher, a complete set of gauges and a small forge have increased the utility of the shop. The mechanic is engaged continuously in the manufacture of apparatus.

On the chemical side a set of modern balances enables accurate weighings to be made from minute fractions of a gramme to several kilograms. High-class spectroscopes, polarimeters, refractometers are available. Modern colorimeters and nephelometers are in use. A large range of standard solutions are ready for the investigator. A store of uncommon drugs and chemicals and of infrequently required glassware is awaiting the day when some research worker will make use of them. Furnaces for making estimations of carbon and nitrogen are available. The laboratory has a fine set of standard electrical instruments for determinations of electric motive force and conductivity measurement. Standard thermometers, standard weights, standard measures and standard barometer are available for comparative purposes. The laboratories are well equipped for analyses of gases, with a number of Haldane's apparatus and a large Bone and Wheeler set. Barcroft's differential manometers are used for estimations of the gases of blood. The laboratory is able to supply facilities for any class of research in biological chemistry and has considerable potentialities for research in organic chemistry and physical chemistry.

In experimental physiology and pharmacology the department is not so well provided with apparatus. A modern kymograph has been added and duplicates the instruments for studying blood pressure. Good recording cylinders are also in the store. There have been, however, few workers in these spheres, so that there have not been the years of preparation in this direction. A standard metre cathetometer and a high-class optical bench still await an investigator to make use of them.

The general physiological and microscopical room has a good supply of microscopes and lenses, a couple of outfits for microphotography, a store of stains and reagents. Work in this sphere has been not carried very far apart from teaching purposes.

Brief History of Research.

With a few exceptions, all members of the staff have made contributions to the progress of medical knowledge. Sir Thomas Anderson Stuart, who directed the department for nearly forty years, described the apparatus already referred to, published valuable papers on the act of swallowing and the accommodation of the eye, gave an exhaustive account of the properties and actions of *pituri* and described many interesting illusions in his studies of the psychology of vision. Sir Almroth Wright, when assistant to Sir Thomas, published a paper on the tissue proteins and their relation to intravascular coagulation of the blood. Dr. C. J. Martin investigated the action of Australian snake venoms, continued the studies of the effects of nucleo-proteins in coagulation and devised the process of using a porcelain filter holding gelatine or silicic acid in its pores. Dr. Moseley studied the coagulation of milk by pancreatic enzymes. Professor E. C. Grey described the lipoids of human brains. Miss E. Pinkerton measured the percentage of oxygen and carbon dioxide in successive portions of expired air. Present members of the staff have investigated the action of secretin, the conditions of precepitin reactions, studied hæmolysis of blood by snake venoms, separated the amino acids of egg proteins and of globulin, examined the hibernation of the Australian porcupine, observed various respiratory phenomena in the breathing of man, exhaustively analysed the estimation of small amounts of phosphoric acid and determined the range of variability in human and cows' milk.

Research by the Staff.

The staff of the department endeavours to carry on some investigation as far as teaching duties permit. So far most of the teachers have recognized this duty of the University instructor. There is, however, little recognition of research within the University or within the medical profession. Research by the University teacher is still regarded as a private matter and is frequently referred to as being separate from his official duties and for his personal advancement. The spirit of research is, however, growing and men do research work, although it retards their professional advancement in some cases.

Research by Fellows and Medical Practitioners.

The Linnean Society of New South Wales makes provision for research in biological chemistry and it has appointed Dr. J. M. Petrie, a Fellow engaged continuously in bio-chemical work for approximately fifteen years. Dr. Petrie has been able to study medicinal principles in plants growing in Australia. His chief work has been done on the atropine group which occurs in numerous plants found in different parts of the country. He has further made an exhaustive study of the distribution of cyanogenetic glucosides in grasses and other fodder plants. He has separated strychnine from the native strychnine plant and has examined the poison of the giant nettle tree. He has laid some foundation of a research into the utilization of nitrogenous products in growing plants.

Research by Students.

Students in science and in medicine have been encouraged to do research work. At the present time every medical student is making observations on his own circulation, respiration and temperature, while a prize is offered for the continuation of these studies. Few medical students have, however, made themselves sufficiently profi-

cient in chemical and physical training to take up fields of physiological and pharmacological inquiry. The student of science with two and usually three years' study in chemistry or physics attains this proficiency. The great improvement in the teaching of the basic sciences of physics and chemistry which is coming at the present time into operation, will no doubt do much to remedy these unfavourable conditions.

FACILITIES FOR RESEARCH IN THE DEPARTMENT OF PHYSIOLOGY AND BIO-CHEMISTRY.

By T. Brailsford Robertson, Ph.D., D.Sc.,
Professor of Physiology and Bio-chemistry, University of Adelaide.

The Department of Physiology and Bio-Chemistry, with which is associated the Department of Histology, are situated in the Darling Building, occupying the first and a portion of the ground floor. The staff consists of the Professor of Physiology and Bio-chemistry, the Lecturer in Histology, a technician, two demonstrators and two cadets. The demonstrators are required to assist in teaching for two terms only, so that the first or third term, as the case may be, and the long vacation are free for the prosecution of research. As a condition of the appointment is that the demonstrators shall engage in no outside work, they are expected to utilize their free time in the prosecution of research. This freedom from teaching duties for a considerable proportion of the year, together with the full use of the facilities of the laboratory, is regarded as forming an important part of the emolument for the services they render in teaching and the salaries are consequently fixed at the comparatively low figure of £200.

In addition to these members of the teaching staff, the department supervises the work of a whole-time bio-chemist, appointed by the Adelaide Hospital, who carries out the bio-chemical analyses which are required by the hospital staff and also for outside medical practitioners. The duties of the bio-chemist are largely of a routine nature and continuous throughout the year. Nevertheless appointees have found it possible to carry on important researches of a bio-chemical nature in connexion with their duties.

The Professor of Physiology and Bio-chemistry is also Director of Research under the Animal Products Research Foundation, under the terms of which the income, about £500 *per annum*, is to be expended upon investigations on the growth and nutrition of animals. Extensive investigations of this character are in progress, particularly with reference to the effects of organ extracts and other bio-chemical preparations upon the growth of mice and upon the spontaneous development of cancer in these animals.

At the present time, in addition to the staff above mentioned, a number of persons are engaged in research in the laboratories of physiology and bio-chemistry. During the past year investigations have been carried out upon the growth of animals, the multiplication of infusoria, the proportion of globulins and albumins in the blood-plasma in various disease conditions, the purification of proteolytic enzymes, the influence of the composition of saline media upon intestinal muscular rhythm, the influence of ultra-violet light upon the skin, the effects of diets lacking in cystine, the determination of the hydrogen ion concentration of blood, the excretion of phenols in relation to diet, the refractive indices of solutions of zein, the production of experimental hyperpyrexia, the metabolism of nucleic acid and, latterly with the kind permission of Professor J. J. R. Macleod, on the properties and effects of "Insulin."

Every facility of the laboratory is at the disposal of medical men who, with permission of the Council, desire to undertake research in these subjects.

PHYSIOLOGICAL LABORATORY OF THE UNIVERSITY OF MELBOURNE.

By W. A. Osborne, M.B., B.Ch., D.Sc.,
Professor of Physiology, University of Melbourne.

The material equipment for research in the Physiological Department of the University of Melbourne may fairly be described as good, the only impediment in the vigorous prosecution of research being the heavy routine teaching duties of the members of the staff. For some help and direction are as a rule necessary with each graduate student.

The various research activities which have been carried out and for which full equipment exists, fall into two general classifications. There is, first of all, that type which is intimately connected with clinical needs and which the medical graduate naturally prefers. In many cases, the technical skill required is no other than that put in practice in the operating theatre or by the bedside. As examples of this class I may mention the published works on nerve-grafting and nerve-bridging, ovary transplantation, experimental duodenal ulcer, adrenalin treatment of poisoning and so forth which have emanated from this laboratory. The facilities for this type of work are of a high order. A skilled assistant and a properly equipped operating room are at the disposal of those who desire to follow up an original idea with experimentation.

In some cases, knowledge and manipulative skill other than that acquired in medical training and practice are required. Whether such researches are welcome depends entirely on the applicants. It is a pleasure to have a research graduate who will patiently practise some difficult procedure or deftly handle a delicate instrument until he is thoroughly master of the method. On the other hand, the man who insists on attacking a quantitative measurement for which he is unfitted by training and temperament and who seeks irresponsible amateur advice during the course of his work, is not worth the time spent on him.

The second type of research work may be described as more properly physiological—the first overlapping a good deal into the domains of experimental pathology, pharmacology and experimental medicine. This latter class is reserved for non-medical science graduates who are not interested in immediate medical applications and who bring to bear on the problems a better training in physics and chemistry. Their contributions to knowledge are concerned with the theory of the subject and with comparative physiology. Naturally one cannot foretell that a direct utilitarian application will not arise.

The laboratory is particularly well equipped with instruments of precision of physical and physico-chemical character. Measurement of extinction coefficient, ultra-violet absorption, electric conductivity, hydrogen ion concentration, the application of the string galvanometer to heart action and heart sounds can all be called instantly into requisition. The laboratory has recently acquired thermionic valve apparatus for the registration and amplification of heart sounds.

A medical graduate who has enthusiasm and whose choice of research appears to the Director to have some promise, is made welcome. No research fee is demanded and ordinary laboratory material is placed gratis at his disposal. He is, however, expected to pay for costly chemicals, including alcohol and animals required for experimental purposes. In those cases where the applicant has not a definite outline of work or any plan of his own, and places himself at the Director's descretion, every effort is made to choose a field lying well within his specialty and of direct medical or surgical value.

In addition to the Medical Library, which is close by, the Physiological Laboratory has a departmental library of books and journals constantly needed for reference.

UNIVERSITY OF MELBOURNE.

Provision for Medical Research.

By H. B. Allen, Kt., M.D., B.S., LL.D.,
Dean of the Faculty of Medicine; Professor of Pathology.

In every professional department the University Regulations provide that "for original research carried on with the consent and under the direction of the professor, the laboratories will be open *gratis*, except as regards such payment for material and special attendance as may be considered necessary by the professor."

Until recently, the Victorian Government provided £2,000 a year for research scholarships within the University, and medical research shared in this provision. The vote was recently withdrawn, but it is hoped that soon the vote will be wholly or partly restored. The University has a private endowment of £5,100 the income of which is available for general research.

Through the generosity of Sir John Grice (Vice-Chancellor), supplemented by the Government, provision is made for a Cancer Research Scholar who receives £250 a year. The managers of the Melbourne Hospital provide board and residence for the scholar.

A clinical research fund has been established by the generosity of many medical practitioners, under which approved graduates are appointed research scholars with allowances varying with the time given to the research and the expenses incurred. The fund now stands at £1,275. Subscriptions to this fund may be forwarded at any time to the Registrar.

In conducting research the University departments work together and maintain association with various hospitals and institutes. Thus in questions of pathology, work might be done with Sir Harry Allen in pathological anatomy and histology, including work in the Museum of Pathology, with Dr. R. J. Bull, in the University laboratories of bacteriology, with Professor Osborne in physio-pathology, with Acting Professor Young in bio-chemistry, with Dr. Sydney Patterson at the Walter and Eliza Hall Institute in any of these departments, with Dr. Penfold at the Commonwealth Serum Institute and at any of the clinical hospitals, whether general or special. Similarly research in anatomy or physiology often extends beyond the corresponding professional department to other departments in the University or in allied institutions. Clinical researches centred in the hospitals easily spread to University departments or elsewhere. The lecturers who assist the professors, are actively engaged in research and always ready to advise and encourage others.

THE RESEARCH FACILITIES OF THE DEPARTMENT OF ANATOMY, UNIVERSITY OF SYDNEY.

By John I. Hunter, M.B., Ch.M.,
Professor of Anatomy, University of Sydney.

Histology and Embryology.

The Department of Anatomy of the University of Sydney will undergo a considerable expansion this year on account of the transference to it of the sub-department of histology. This addition will lead to the grouping together of histology and embryology for the purpose of teaching and research. New laboratories have been provided to accommodate this sub-department. These are approaching completion and will be in operation during the current year. Special provision has been made for advanced students of anatomy proceeding to a science degree, either in connexion with their medical studies or independently thereof. Similar facilities will be available for research graduates from the beginning and every endeavour will be

made under the new conditions to meet requirements and extend facilities in this direction. Apart from strict research work which calls for technical skill and preliminary training, arrangements can be provided for several approved graduates who wish to improve their knowledge of laboratory technique, and so acquire the training necessary for advanced histological work. Dr. J. R. Dixon is at present in charge of this work.

This statement represents the actual state of affairs which will prevail when the extensions actually in the course of completion are in use. It is greatly to be regretted that this organization does not include a private room, including laboratory accommodation for all members of the staff desirous of carrying on research work. Professor J. T. Wilson built up a finely equipped laboratory which enabled him to carry on his research work of which the contributions to and knowledge of human and monotreme development are of special importance. Such a unit as this should be provided for each full time member of the staff and others actively engaged in research, such as research fellows.

Owing to the activity of Professor Wilson, a fine collection of human embryological material consisting of over two hundred and fifty specimens is available for study. Past experience shows that a research graduate could readily augment this material in any required direction by exploiting the abundance of material which would be placed at his disposal by clinicians. The paramount need of the moment is to establish standard collections of early stages of local fauna. An excellent beginning has already been made by the Department of Zoology in this connexion. Australian laboratories well equipped and providing such material would serve to attract workers from other centres abroad. An organized attempt to establish such laboratories actively engaged in the collection of material and research is especially desirable.

Neurology.

For the past two years regular provision has been made for carrying out aseptic operations within the Department of Anatomy. Up to the present this has been mainly availed of for the purposes of experimental investigations of problems relating to the peripheral and central nervous systems, notably by Dr. N. D. Royle, whose work upon flaccid paralysis and the symptomatology of complete transverse lesions of the cord is about to be published. A collection of gross and microscopical specimens embracing all mammalian orders is only in its very earliest phases of development. But here the remarks made in regard to the conservation of embryological material of our local fauna applies with equal force.

Anthropology.

A collection of osteological material is immediately available for further investigation in conjunction with work already being carried on by the departmental staff and research students (Dr. A. N. Burkitt, Dr. Standish Lightoller and Mr. Gullberg). This material is about to be housed in a special enclosure of the Wilson Museum extensions. This is a temporary expedient and is quite inadequate for any extensive anthropometric work. It is specially desirable that studies should be carried out in somatic anthropology. The dissecting room provides a considerable amount of material which, however, is not suitable for complete examination, but special care is being taken in the dissection of the most important material. The usual procedure has been for the Senate to appoint research graduates as honorary demonstrators of anatomy to facilitate observation of the material used in the routine work. Work is being carried on at present towards the investigation of the anatomy of the Australian aboriginal and some small amount of material is available for an extension of this study.

Dental Anatomy.

The nucleus of a human and comparative collection is available for research in dental anatomy. Augmentation of this material is especially desirable. Dr. A. N. Burkitt is at present in charge of the two foregoing sections.

Library.

A considerable anatomical literature, especially with regard to the more important journals is available in the department on loan from the Fisher Library. This literature is being especially housed for the use of the staff and research students. For better coordination of the various activities of the department and to promote discussion regular meetings of all those interested in research and current anatomical literature will be held during the current year.

THE ANATOMICAL DEPARTMENT OF THE UNIVERSITY OF MELBOURNE.

By R. J. A. Berry, M.D., F.R.S. (Edinburgh),
Professor of Anatomy, University of Melbourne.

Anyone who has studied or read the 536 pages of "Medical Research and Education" by various leading American medical men can form only one conclusion—that research is essential to the progress of medicine and that it is to our Universities that we ought primarily to look for such research, or at all events, for its fostering and encouragement. This has long been recognized and practised in the past, but it is open to doubt if it is sufficiently realized how as the result of war the Universities have more and more receded from their proud position of prosecutors of and leaders in all medical progress.

As a result of a conference between certain of the Universities and the then Minister for Defence in the Commonwealth, held in Melbourne in 1914, at which the former proffered their services in any capacity, they were informed that it was the duty of all heads of departments to remain at their teaching posts and thus to insure a steady supply of

young medical officers for the Australian Imperial Force. This duty, although unpalatable to many, was loyally carried out, though it does not appear that it has since either been recognized or remembered. In accordance with the wishes of the Minister the younger members of the University medical staffs were freed for active service and extra work was, in every case, cheerfully undertaken by those left to carry on. Teaching thus became the supreme duty of the Universities and research, except in so far as it might have a direct bearing on war and its aftermath, was practically deleted from University work. The result of the Government's call for medical officers was followed by an inrush of students into medicine and in every Australian University there was the same tale. Overwhelming numbers, insufficient accommodation and a pronounced shortage of staff. In one University Department one professor was left to cope single-handed with some three hundred and fifty students for a period of ten weeks. With the signing of the armistice the position rapidly became worse and Departments which, like the Anatomy Department of the University of Melbourne, had accommodation for two hundred students, were called upon to provide for five hundred. Latterly, attempts have been made to cope with the situation, but it necessarily follows that under these conditions continuous research has since the outbreak of war been practically impossible. Even at the present moment were any research scholar to request permission to undertake research work in anatomy in the University of Melbourne, he would have to be refused, for the simple reason that every room in the Department is already occupied with the teaching of the students.

It cannot be too strongly emphasized that any institution of the calibre of a University, which is not advancing knowledge by research and investigation, is a waning power and is slowly but surely sinking to the level of a technical school. Further, if that school be altogether divorced from the hospitals and other places where the practising members of the profession mostly congregate, the position is rendered worse and it is very much to be feared that this is exactly what is happening in certain Universities, which have not followed the advice of the Carnegie Foundation for the advancement of teaching. As the result of an investigation of all the principal medical schools in Europe, it is expressly laid down as an essential condition of medical progress that the teaching and research departments of the medical school of a university, no matter where the rest of the university buildings may be, must be alongside a hospital. It is now abundantly clear that, unless this procedure be adopted, research in a university will be but a feeble plant of sickly growth and early death.

The new Anatomy Department of the University of Melbourne will remove many of the existing difficulties in the prosecution of medical research, but will materially increase others. This last because it is in precisely the wrong place—far removed from the profession. As its building practically settles the fate of medical education and research in Melbourne for the next generation, because it ties the Medical School to the existing site, it is much to be feared that even its palatial accommodation will do little to stimulate research amongst members of the profession as a whole.

As a building with ample accommodation for all —students and medical men—it leaves little to be desired, apart, of course, from the usual peculiarities of the architectural mind which seems to imagine that shadows cast by Gothic columns of stone are an adequate substitute for light and that lavatories should be the most prominent feature of a main entrance. There will be ample provision for any student of research in human or comparative anatomy, histology, embryology, physical anthropology, operative surgery, experimental psychology or neurology, always provided the necessary extra equipment is forthcoming. There will be a most modern lecture theatre, fully provided, it is hoped, with all necessary projection apparatus, including even the slow moving cinematograph. In other parts of the building will be found that necessary adjunct to all medical progress, a complete card catalogue of current literature and what has become almost equally necessary to progress, a rich collection of lantern slides, micro-photographs and all necessary apparatus for enlarging these collections. This much is certain that no medical man need be deterred from undertaking research in the new Anatomy Department for lack of facilities, for he will find every assistance and encouragement.

As regards the larger problem it is and must ever be a matter of profound regret that, in view of the overwhelming support so generously given by all and the fact that land was actually offered in 1915 for £13,000 for a building site between the two leading clinical hospitals for the Medical School, a policy of timidity prevailed. The opportunity when the foundations of the new school were laid having been lost, probably for ever, it was not deemed necessary to raise the whole question of the site of the Medical School *de novo*, but there was much to be said then and still is for the transference of the whole Medical School of the University of Melbourne, to the Royal Park, where there is already the nucleus of a research school of a high order. This, completed by the addition of the Medical School of the University of Melbourne, and a new hospital for the suburbs of the north-western periphery of the city would have formed a medical scheme which would have held its own anywhere.

The future of the Medical School of the University can no longer be regarded as being in the hands of the men of my time and generation. It is to our younger graduates, many of them men of great ability and high integrity, that the future of this medical school is entrusted, and I can only hope that by their contributions to knowledge, by their researches and by their relief of suffering human nature they will add to the glory of medicine and in the time of their prosperity will not forget the deep debt they owe to their *alma mater*, for its future is in their hands and theirs only.

THE PATHOLOGICAL LABORATORY AT THE CHILDREN'S HOSPITAL.

By Reginald Webster, M.D. (Melbourne),
Pathologist to the Children's Hospital, Melbourne.

The existing Pathological Block at the Children's Hospital, Melbourne, was built in the year 1913.

The erection of a substantial building, comprising laboratories, *post mortem* room and pathological museum marked the inception of a big forward movement in the pathological work of the Hospital. Prior to 1913 the institution was not self-contained in this respect and specimens upon which a pathological report was required, were sent to the Bacteriological Laboratory of the Melbourne University, where the work was discharged in an honorary capacity by Dr. R. J. Bull. At that period the autopsies were performed by the Honorary Pathologist, Dr. H. Douglas Stephens, who was assisted by the resident medical officers.

During the first six months of 1914, Dr. D. M. Embelton worked in the then new laboratory on a half-time basis. In June, 1914, the writer was appointed as a full-time salaried officer with one lay assistant. Through the intermediate stage of a half-time qualified assistant the staff has attained its present complement of two qualified and two lay assistants, all of whom work whole time.

The opening of the new Baby Ward and the amplification of the medical curriculum, by which students are required to attend the hospital in groups for the whole day over a period of six weeks, led to the appointment of a whole-time qualified assistant in January, 1921. This position is held at the present time by Dr. H. Boyd Graham.

Although systematic *post mortem* work and the variety of measures of laboratory diagnosis constitute the daily routine, it has always been the wish of the Committee of Management and the objective of the pathologist in charge to maintain research study.

Laboratory workers will recognize that the daily round frequently renders this a difficult task, but if the routine work be carried out in such a manner that it has scientific value, the problem is solved to some extent. Applying this principle, the writer entered on a study of the types of pneumococci prevailing in the various pneumococcal infections in children during last winter and it is proposed to continue the work in the coming season. It is hoped that sufficient data will be collected to enable an estimate of the relative prevalence of the several types to be formed and to compute the effect of anti-pneumococcal serum in the direction of reducing the mortality and the incidence of complications in identified Type I. infections.

During the recent summer months bacteriological work on infantile diarrhœa has been the principal activity of the laboratory. In this particular also, although bacteriological examination of the stools is required for its therapeutic and prognostic value by the members of the honorary staff, an attempt has been made to carry out the work with scientific thoroughness. One useful outcome of the work has been that it has been possible to render some assistance to the workers at the Walter and Eliza Hall Institute in their serological classification of endemic strains of *Bacillus dysenteriæ* and with this object upwards of forty strains of the Flexner group of this bacillus have been forwarded to the Institute.

It is anticipated also that at the end of the season an analysis of the case histories of infants suffering from proved dysentery will be of value in estimating the therapeutic efficacy of anti-dysenteric serum in the acute infective colitis of infancy.

In the past various communications, all of which have appeared in The Medical Journal of Australia, have emanated from the laboratory of the Children's Hospital. Articles dealing with cerebro-spinal meningitis, polio-myelitis, blood culture in summer diarrhœa, lumbar puncture and meningitis have been based on bacteriological and experimental studies conducted in the hospital laboratory, which also provided facilities for a large part of the clinical hæmatology embodied in Dr. S. O. Cowen's recent notable article on familial hæmolytic splenomegaly.

A useful function that can be discharged by a comparatively small laboratory such as that of the Children's Hospital is to act as a clearing house for the collection and dispatch of pathological material of use to larger institutions in the prosecution of research work. The manner in which cooperation with the Walter and Eliza Hall Institute is practised, has already been indicated and to the Commonwealth Serum Laboratories tuberculous material of all descriptions is sent for the purpose of forwarding an investigation into the relative prevalence of human and bovine infection in human subjects of tuberculosis.

The Committee of Management of the Children's Hospital have always taken a long-sighted view of the needs of the pathological laboratory. For the various research studies and the advances in maintenance cost which inevitably follow increasing activity, funds have always been made available. With one new ward for babies open and another one in near prospect the Hospital has now reached a stage at which further expansion in the laboratory, involving structural alterations, has become a necessity.

A scheme for further development has been formulated and it is sufficient for the present to state that the ladies of the Committee view it very sympathetically.

The consideration invariably extended by the Committee has in the past proved a great encouragement to those responsible for the work of the pathological department.

THE LABORATORIES OF THE LUNACY DEPARTMENT OF NEW SOUTH WALES.

By Oliver Latham, M.B., Ch.M. (Sydney),
Pathologist to the New South Wales Department of Mental Hospitals.

The Pathological Laboratory of the Department of Mental Hospitals of New South Wales has always offered facilities for advanced students

doing special work in the pathology of mental and neurological diseases.

During the directorship of the late James Froude Flashman many distinguished scientists made the laboratory their headquarters when carrying out with him investigations on the morphology of the aboriginal skulls and brains and for investigating by experimental researches the various cortical and spinal tracts in the lower animals peculiar to Australia. Besides these subjects, many younger graduates have studied the Bordet-Wassermann reaction here or used our materials in their own special researches. Much of this material is still available for interested students. More recently the laboratory has been called upon to undertake the examination of material from persons who have died of many obscure neurological conditions, so that a considerable collection of pathological material and slides suitably stained is available for students, who are shown methods of preparation and examination, either from selected text-books or prepared notes and numbered slides. Included in this series are specimens showing normal and pathological tissues from the brain coverings, intracranial vascular tissues, cortex, medulla, cord, nerves and ganglia from many persons dead of insanity, such as general paralysis of the insane, "X disease," *encephalitis lethargica*, acute delirious mania, and of neurological conditions, such as primary lateral sclerosis, Friedreich's disease, ataxic paraplegia, pernicious anæmia, *tabes dorsalis*, tabo-paresis, cerebral and pontine hæmorrhages and softenings, hæmatomyelia, cord tumours and anterior polio-myelitis and von Recklinghausen's disease, disseminated sclerosis and leprosy. Full facilities for neuro-histological work are consequently available.

The examination of the blood and cerebro-spinal fluid for variations in its chemistry, as well as cell content, has been made available for use in our mental hospitals and medical and science students can perform Folin's and Wu's colorimetric methods for the estimation of the total non-protein nitrogen, urea nitrogen, creatinine, uric acid, hæmoglobin and sugar, Van Slyke's carbon dioxide combining power of the serum, as well as volumetric estimation of sugar content of blood by the ferri-cyanide-iodine-starch method. The cerebro-spinal fluid is examined for the gold "sol" reaction and many other reactions.

Special facilities are given for the correct understanding of microscopic phenomena and students obtain many hints how to overcome the difficulties of dark ground illumination and how to modify their own instruments to meet special circumstances. A little bacteriology is included, for the members of the staff of the Department are constantly called upon to make vaccines and special media are sometimes needed for the growth of intestinal organisms and of tubercle bacilli.

The newer diagnostic methods are demonstrated and students visiting the hospitals are required to test the blood and urine before and after the injection of suitable quantities of adrenalin. They obtain some insight into the functional activities of various glands of internal secretion by ascertaining the altered quantities of sugar in the blood. A few of the commoner phenomena associated with the urinary functions are taught. The importance of examining for infections, for total acidity, indican, foreign substances (disclosing perverted habits) is impressed. A few test meals are included, chiefly to bring out the common absence from the gastric secretions of free hydrochloric acid in patients with depression and the examination of the alveolar air for the carbon dioxide content.

VICTORIAN LUNACY DEPARTMENT PATHOLOGICAL LABORATORIES.

By W. A. T. Lind, M.B., B.S. (Melbourne),
Pathologist, Victorian Lunacy Department.

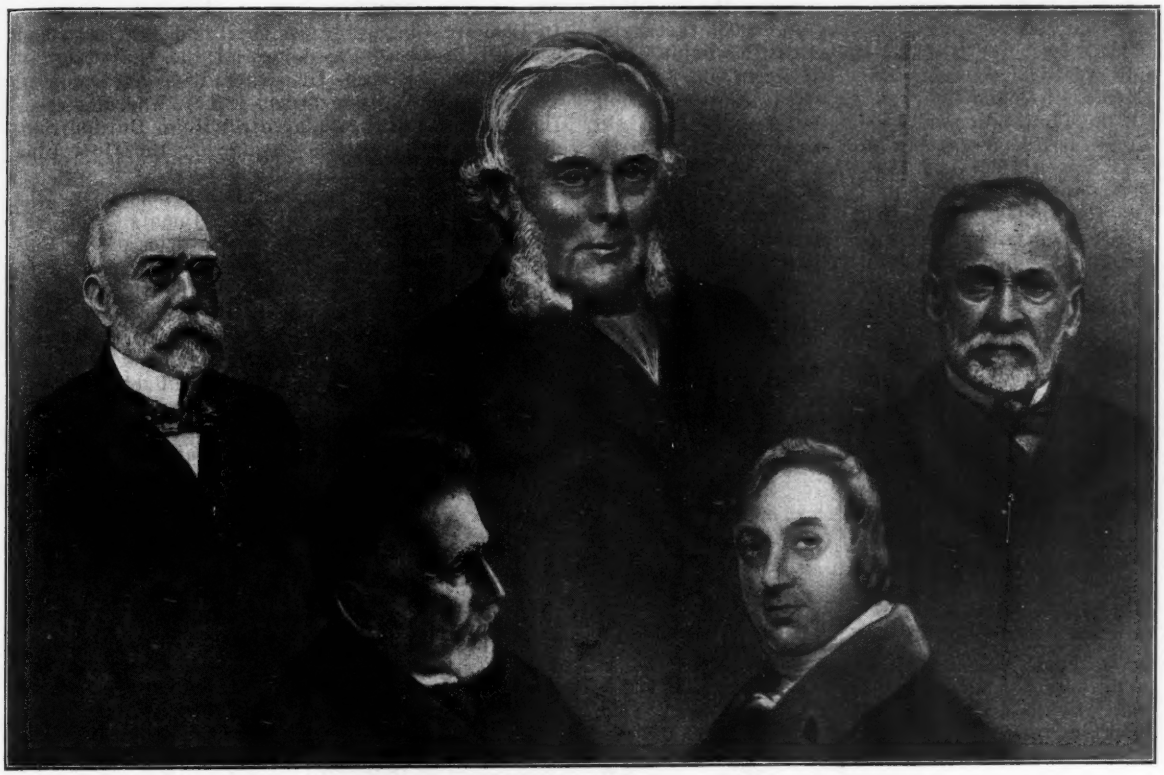
There are two laboratories belonging to the Victorian Lunacy Department. One is at Kew and the other is at Royal Park. The laboratory at Royal Park is attached to the Acute Mental Hospital, which is about half a mile from the Royal Park Railway Station and a few minutes by the electric train from Melbourne. There is no conveyance between the Royal Park Station and the Laboratory. The Laboratory at Kew is attached to the Hospital for Insane, Kew, and is about one and a quarter miles from the train and tram which connect with Melbourne about five miles distant. Cabs ply regularly between the train and Hospital during the afternoon only, at a charge of sixpence each way, but are available from the rank at all other times at the rate of one and sixpence each way.

The work done at the Laboratories is restricted to investigating matters connected with psychiatry and the ill-health of the patients in the hospitals of the Victorian Lunacy Department. This includes the *post mortem* examination of every patient dying in the institutions, the findings being studied in conjunction with the clinical notes. This *post mortem* examination is compulsory by authority of the *Coroner's Act* and is a great benefit to those engaged in research work. Other routine work includes section cutting and staining, the carrying out of the Wassermann test, the examination of sputum, urine and other body fluids and tissues and the making of vaccine.

Any medical practitioner desiring to obtain a knowledge of laboratory technique may do so by assisting in the routine work of the laboratory without payment of fee.

Any medical practitioner who wishes to carry on research work, is welcome to do so, provided the research is for the benefit of the study of psychiatry. Such research worker would be appointed an assistant medical officer of the Hospital, without salary, to enable him to enter the wards and make such examinations of patients from time to time as may be necessary to the research. No fee will be charged any research worker and the use of the laboratory apparatus will be free, but if any extra apparatus is required which is not essential to the ordinary laboratory work, the research worker must be prepared to provide it himself. It is stipulated that any fresh knowledge so gained must be made known to the Inspector-General for the benefit of the Department.

Five Giants in Medical Research.



Robert Koch. Paul Ehrlich. Lord Lister. Edward Jenner. Louis Pasteur.

Some Famous Research Institutes.

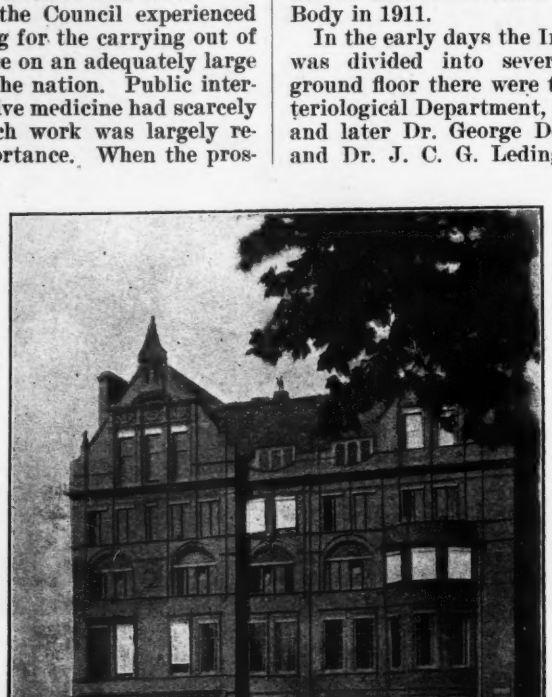
THE LISTER INSTITUTE OF PREVENTIVE MEDICINE.

On July 1, 1889, a meeting was held at the Mansion House, London, "for the purpose of taking steps to present M. Pasteur with a grateful acknowledgement from this country of his gratuitous kindness in Paris to over two hundred British patients who had been bitten by rabid animals." The result of this meeting was a donation of £2,000 to Louis Pasteur for the use of the Institut Pasteur in Paris. The meeting appointed a committee to act on its behalf. This committee informed the people of England that there was a need in the United Kingdom of an institute similar in character and purpose to the Institut Pasteur in Paris or to the Hygienisches Institut in Berlin. As a result of this recommendation the British Institute of Preventive Medicine was incorporated on July 15, 1891. Its objects, as set forth in the Memorandum of Association, were to provide laboratories, to appoint a scientific staff, to institute lectures and demonstrations, to issue publications of the transactions of the Institute and to found a library. The President of the Council was Sir Joseph Lister and the members included the leading authorities in biology, chemistry, medicine and veterinary and agricultural science. The trustees of the late Richard Berridge contributed £20,000 and the Grocers' Company gave £10,000 to the funds. In 1893 the College of State Medicine was amalgamated with the Institute and temporary premises were obtained in Great Russell Street. A staff was appointed and Allan Macfadyen was appointed Director. The accommodation and the equipment were insufficient for extensive work, but a considerable amount of progress in organization was made. About this time the late Duke of Westminster offered the Council of the Institute a magnificent site in Chelsea Gardens, facing the River Thames, at a price that must be regarded as nominal. The offer was accepted and Mr. Waterhouse, R.A., designed a fine building. Notwithstanding the smallness of the Council's possessions, the building of the southern wing and central portion was commenced almost immediately. This building was completed in May, 1897. In the following year the Jenner Memorial Committee determined to make a considerable gift of money to the institute as a memorial to the work of Edward Jenner. The name of the Institute was changed by arrangement to that of the Jenner Institute of Preventive Medicine, but in the course of the following few years the Council were considerably embarrassed by the

confusion which arose with a commercial firm known as "The Jenner Institute for Calf Lymph." It was therefore decided to rename the institute for the second time. In August, 1903, the name "The Lister Institute of Preventive Medicine" was adopted. The money received from the Jenner Memorial Committee was applied to the foundation of the Jenner Memorial Scholarship at the Institute for scientific research "on Jenner's own lines."

Between 1895 and 1898 the Council experienced grave difficulties in planning for the carrying out of the functions of the Institute on an adequately large scale to serve the needs of the nation. Public interest in the subject of preventive medicine had scarcely been awakened and research work was largely regarded as of academic importance. When the prospects appeared to be at their worst, Edward Cecil Guiness, Lord Iveagh, came to the rescue. He recognized that it lay within his power to contribute toward the elucidation of the causes and prevention of disease by endowing the Institute out of his great wealth. He gave a quarter of a million pounds sterling.

In the year 1896 diphtheria antitoxin was introduced into England and the need for a local source of preparation was felt. In 1898 premises were secured in Sudbury, a few miles to the north-west of London, and diphtheria antitoxin was prepared for the first time in England at this department. In 1902 a permanent site for the Serum Department was purchased at Elstree, in Hertfordshire. The property is known as Queensberry Lodge. It comprises extensive stabling arrangements, suitable laboratories and other good buildings and about twenty-eight acres of pasture land.



Lister Institute: Centre and South Wing Before Completion.

During his Presidency of the Institute Lord Lister gave the munificent sum of £20,000. A further bequest by the trustees of the late Richard Berridge of £26,000 was utilized for the establishment of a laboratory for researches into the bacteriology and chemistry of water. When the Council found itself relieved of the financial anxiety and the adequate equipment of the laboratories became possible, a change was effected in the management of the Institute. Lord Lister was appointed President and a Governing Body, with Sir Henry E. Roscoe, F.R.S., as Chairman, Lord Iveagh, Sir John Burdon Sanderson, F.R.S., Sir Michael Foster, F.R.S., Dr. (now Sir John) Rose Bradford, F.R.S., and Colonel David Bruce, F.R.S., as members and Mr. J. Luard Pattison as Honorary Treasurer, replaced the Council. In 1903 Dr. Charles James Martin, F.R.S., who had been Professor of Physiology at the University of Melbourne, replaced Dr. Macfadyen as Director. The late Sir William Osler, F.R.S., and Professor H. Starling, F.R.S., replaced Sir John Burdon Sanderson and Sir Michael Foster on the Governing Body in 1911.

In the early days the Institute at Chelsea Gardens was divided into several departments. On the ground floor there were the laboratories of the Bacteriological Department, in charge of Dr. Macfadyen and later Dr. George Deane. Both are now dead and Dr. J. C. G. Ledingham has succeeded them. In this department routine bacteriological and biological diagnosis work was conducted. In addition, a considerable amount of bacteriological research work was conducted. It was here and in the basement where the apparatus for freezing air was set up that Allan Macfadyen and Sydney Rowland conducted their ingenious investigations on the extracting of an antigenic substance from *Bacillus typhosus* ground when frozen by means of liquid air.

In the basement were the larger centrifuges, sunk into concrete wells, the ammonia refrigerating plant, the furnaces, the mechanic's shop and the rooms for the preparation of culture media. Later, when A. E. Boycott, J. S. Haldane and G. C. C. Damant undertook the investigation of the condition known as diver's palsy or caisson disease, the late Ludwig Mond, F.R.S., erected a large decompression chamber at the outlet of the basement to the open space or yard in which the animal house is situated.

On the first floor were situated the chemical laboratories under Dr. A. Harden, while the Physiological Laboratory under Dr. J. B. Leathes (later under S. G. Hedin) was also accommodated. Dr. Harden and Dr. W. J. Young (now Lecturer in Biochemistry at the University of Melbourne) carried out their admirable researches on yeast fermentation chiefly in a relatively small laboratory at the back of the building.

The second floor contained the Director's laboratories and laboratories of various other members

of the staff. At a later date a large laboratory on this floor was equipped by Dr. Martin for work on disinfectants and other physico-chemical problems and the researches undertaken by him in association with Dr. Harriette Chick were conducted in it. On the same floor was the hot room, which was at the disposal of all workers at the Institute.

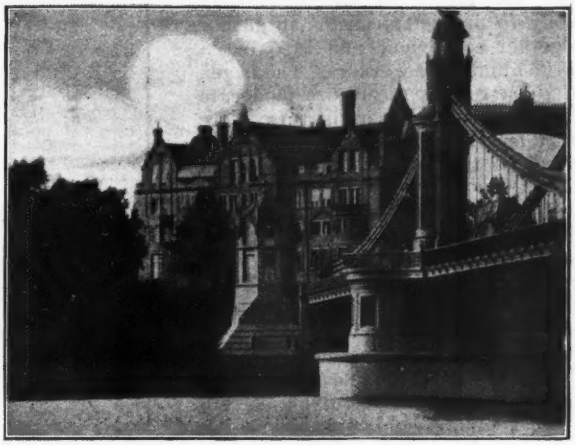
On the third floor Professor Minchin established the Protozoological Department of the University of London. There were also some laboratories leased to the Local Government Board.

On the fourth floor was the library, as well as some other rooms for various purposes and quarters for the caretaker.

Outside the main building was the animal house, with two small laboratories above, while under the roadway were three small laboratories reserved for plague work.

Queensberry Lodge was equipped for the mass production of antitoxic and other sera and vaccines. Dr. A. T. MacConkey was in charge and later Dr. Sydney Rowland joined him.

The income of the Lister Institute was derived from the interest on the funded donations and bequests, aggregating over a quarter of a million pounds, the proceeds of the sale of sera and vaccines through the agency of Allen & Hanbury, Limited, and the payments made by the University of London and the Local Government Board for the use of laboratories. About the year 1908 it was determined that the time had arrived when the buildings should be completed and much greater use should be made of the facilities for research. The period of building entailed some temporary adjustments and discomforts, but the members of the staff manifested patience and tolerance. Some alterations were undertaken in the standing parts, such as the installation of air pipes under positive and under negative pressure in each laboratory and other modern improvements. In 1910 the new wing was completed and the majority of the laboratories were occupied. The Local Government Board's contract expired about this time and the laboratories previously occupied by them became available for the members of the Institute staff. Some laboratories were placed at the disposal of private research workers. Dr. Martin exercised great care before admitting private workers and in each case satisfied himself that this permission would be to the advantage of the Institute.



Lister Institute: Completed Building, Chelsea Gardens.

In 1912, when the *National Health Insurance Act* came into force, the question of research became a live subject on account of the ear-marking of the Government's contribution of one penny per insured person for the so-called tuberculosis benefit. As will be remembered, this provision led to the establishment of the Medical Research Committee under the chairmanship of Lord Moulton of Bank. During the early stages a proposal was put forward for the absorption of the Institute into the scheme. The centralization of the work at the National Institute for Medical Research (formerly Mount Vernon Hospital), Hampstead, led to the temporary abandoning of the proposal and it would appear that the war finally determined the Governing Body to continue the Lister Institute as an independent establishment. Arrangements were made for the accommodation of investigators working under the Medical Research Committee at the Lister Institute. Since the transference of the Medical Research Committee's activities from the control of the National Insurance Commissioner to that of the Privy Council and its change of name to that of the Medical Research Council, many investigations have been undertaken at the instigation of the Medical Research Council by scientists who have enjoyed the hospitality of the Lister Institute.

The salaries paid before the war to the members of the staff were by no means generous. It

Lister Institute: Serum Department, Queensberry Lodge, Showing Stables and Paddocks.

was the policy of the Governing Body to utilize its means to gather together equipment and to enlist a large number of workers. The heads of Departments received a moderate stipend, but the assistants were paid less than a living wage. The result of this policy has been detrimental to research. A handful of enthusiasts continued to work for the sake of science on inadequate salaries. At times these men were compelled to supplement their meagre incomes by engaging themselves as lecturers elsewhere. In other instances young men spent a short time in the laboratories and, just as they were acquiring a reliable technique and were becoming established as useful investigators, the lure of better remuneration impelled them to relinquish the laboratory.

Institut Pasteur: Bacteriological Department.

The atmosphere in the Institute is stimulating and every worker, be he on the staff or enjoying the hospitality of the Institute in another capacity, receives helpful advice and assistance. A number of research scholars have worked at the Lister Institute for short periods during the past few years. There have been many Australian graduates among them. The proportion of women workers has increased since the early days and at present it is remarkable. It is an admirable school for the aspiring research worker, since slovenly methods and inefficient technique are not tolerated at the Lister Institute of Preventive Medicine.

L'INSTITUT PASTEUR.

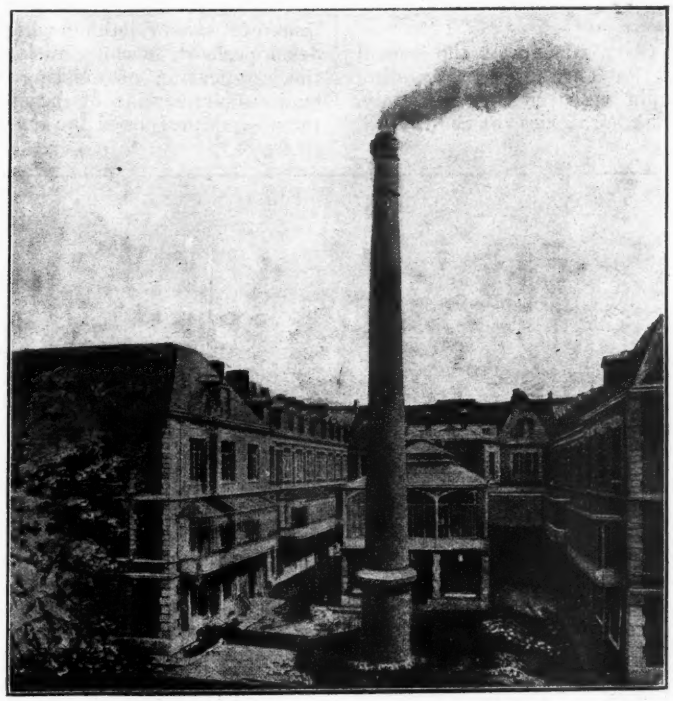
Louis Pasteur started his life as a scientific investigator in a laboratory situated in a little garret in l'École Normale in Paris. The equipment at his disposal was meagre and crude. But the master mind was not deterred by limitation of space or by lack of mechanical aid. He had taught physics at the Lycée at Lille when twenty-six years of age and had been appointed Professor of Chemistry at the University of Strassbourg when twenty-seven. Five years later, in the year 1854, he returned to Lille and in 1857 he became attached to l'École Normale in Paris. His life has demonstrated the wisdom of combining research with teaching. While he was enriching the world with his epoch-making investigations on fermentation, on yeasts, bacteria and other forms of unicellular life, he was filling the chair of geology, physics and chemistry in Paris. It will be within the knowledge of all that in 1870 Pasteur described his methods of combating the disease of silkworms and ten years later he attacked the problems of fowl cholera and anthrax. Next rabies attracted his attention and in 1885 he published a description of his anti-rabic inoculations. Persons bitten by supposedly "mad" dogs sought Pasteur's help in ever-increasing numbers. Notwithstanding the fact that his laboratories had by this time assumed much larger proportions than when he first started in l'École Normale, the accommodation was wholly insufficient for this new purpose.

Institut Pasteur: Hospital.

A public appeal was made in 1886 by the Académie des Sciences for funds to establish a suitable institution, with the result that £100,000 was collected within a very short time. A site was purchased at Vaugirard and a building was erected at a cost of about £40,000. This institute was opened on November 18, 1888. But even these premises proved too small for immedi-

ate needs of the time. The workers found themselves handicapped from want of room and embarrassed by lack of equipment.

In 1894 at the Medical Congress at Buda-pest, von Behring and Kitasato reported the result of their work in connexion with the treatment of diphtheria by antitoxin. Professor Roux, who was already associated with Louis Pasteur at this time, also read a paper on this subject. *Le Figaro* took up the matter and made a further appeal to the people of France. The response was prompt and generous, £40,000 being subscribed. The Government had lent some land at an earlier date and stablings and laboratories were built on it for the purpose of immunizing horses for the preparation of diphtheria antitoxin. A large-minded and benevolent lady whose name has been withheld from the public, recognized the importance of adequate means in research work. She made a gift of money to enable the directorate to purchase about three and a half acres of land between Rue Dutot and Rue de Vaugigard, immediately facing the original site of the Pasteur Institute. On this site a hospital containing one hundred beds was erected. Other benefactors came forward and contributed to the stability of the organization. Baron de Hirsch made a substantial donation for building purposes.



Institut Pasteur: Chemical Department.

About 1896 the original edifice was enlarged and reorganized to form the physiological and pathological department, together with the administrative offices. Adjoining it the chemical department was placed, while the therapeutic department and the hospital constituted the second portion of l'Institut Pasteur as it exists at the present time. It is said that the Master had planned several other departments that have not been developed, but everyone who has been privileged to visit and work in this renowned institution, is impressed by the admirable arrangement and the excellent order and scope.

In the year 1903 Monsieur Osiris, a wealthy Parisian, founded a triennial prize to be given to the person who had rendered the greatest service to the human race during the three preceding years. The first award went to Professor Roux for his work on diphtheria antitoxin. Roux was large-minded enough to hand the £4,000 to his beloved Institut Pasteur. Monsieur Osiris was greatly impressed by the spirit that had impelled Roux to sink his own individuality. He died in 1909 and left the sum of £1,200,000 to the Institut Pasteur. Part of this money was used for the establishment of a laboratory for the investigation of the phenomena of radio-activity. A committee was appointed by the University of Paris and by the Pasteur Institute. Madame Curie was placed in charge of the scientific research and the investigation of the application of radio-active substances to the treatment of disease was left in the hands of the staff of the Institute. In 1910 Madame Catherine Schumacher gave the sum of £40,000 for the further development of scientific research. In this way the endowment of the Institut Pasteur has gradually grown and at present stands at about two million pounds sterling.

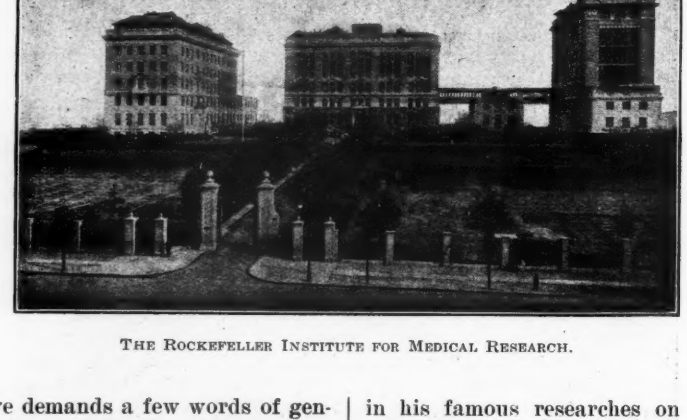
The Bacteriological Institute is divided into four departments or *"services."* The first comprises the Vaccine Department. It is spacious and well equipped and adequately staffed. The second is the Rabies Department, the pattern for numerous other "Pasteur Institutes" scattered throughout the world. The third is the Micro-Biological Department and the fourth the Department of the Director. The fourth department will long be associated with the name of Metchnikoff.

This part of the Institute is accommodated in a two-storied building with annexes. The laboratories are capacious and well equipped. The lecture theatre is adequate for its uses. Professor Roux may be congratulated for an admirable piece of organization in the planning and coordinating of the various laboratories and rooms on the first floor. The animal house for the anti-rabic work is situated in an annex and is picturesque. In characteristic French fashion the entrance is embellished by a bronze group representing the shepherd Jupille catching a savage dog, while on the lawn facing the entrance is a marble statute of *Maternité*.

Since the year 1889 French and foreign graduates in medicine, chemistry and science, as well as undergraduates of the University of Paris, have been admitted to the courses of bacteriology and microbiology. Some attend for the lectures only, while others take a practical course as well. It is recognized as one of the best courses of laboratory technique in the world. In the Director's department original research is conducted, not only by the members of the staff, but by arrangement by competent workers from elsewhere who are permitted to enjoy the hospitality of the Institute.

The Serum Department is well conducted and the veterinary aspect is suitably represented. The products of the Pasteur Institute necessarily have to obtain the approval of a special commission of the Académie de Médecine, like a commercial firm offering sera for sale.

The Institute of Bio-Chemistry forms the second portion of the Institut Pasteur. In this building there are departments of research and of study. There is a special set of laboratories for the investigation of fermentation, another for agricultural chemistry, another for physiological chemistry and another for the classes of the Faculty of Science of the University of Paris. The equipment here is full and excellent. Students and graduates find facilities for conducting advanced work and for original investigations.



The Rockefeller Institute for Medical Research.

Finally, the hospital mentioned above demands a few words of general description. It is constructed on the pavilion system. It is divided into two parts connected by a rectangular central part. It has been designed with a view to the easy isolation of individual patients. The wards and rooms are comely, yet simply designed and furnished. Everything has been sacrificed to the idea of efficient sterilization. Nevertheless the patients are rendered comfortable and enjoy the delightful environment during convalescence. This association of hospital with institution is a great advantage for research in clinical pathology and ætiology of pathological processes.

The Institut Pasteur is a worthy monument of one of the few giants of medical science.

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH.

In the year 1901 Mr. John D. Rockefeller announced his intention of establishing an institute to be known as the Rockefeller Institute for Medical Research in New York. The purpose of the foundation, as described by Mr. Rockefeller, was to furnish facilities for original investigation, particularly in such problems in medicine and hygiene as have a practical bearing upon the prevention and treatment of disease. He set aside the sum of £40,000 for the purpose, but specifically pointed out that this sum was not an endowment. It was to be used in a series of years for current expenses. He determined that the institute should not immediately have a home of its own.

The first act was to secure incorporation under the laws of the State of New York. A board of management was appointed, consisting of William H. Welch, T. Mitchell Pruden, S. Emmett Holt, C. A. Herter, Theobald Smith, Simon Flexner and H. M. Biggs. The Board was required to shape the lines of the work along which the Institute might develope, both in contribution to knowledge and in the application of existing knowledge to human ends. The question of the erection of a local habitation was postponed for the time. It appears that the first few years were used for the development of plans and for the carrying out of important investigations in existing laboratories.

In the year 1904 the first volume of the "Studies from the Rockefeller Institute for Medical Research" appeared, while in 1905 the second volume was published. Simon Flexner was engaged at that time in his famous researches on the bacterial causes of dysentery.

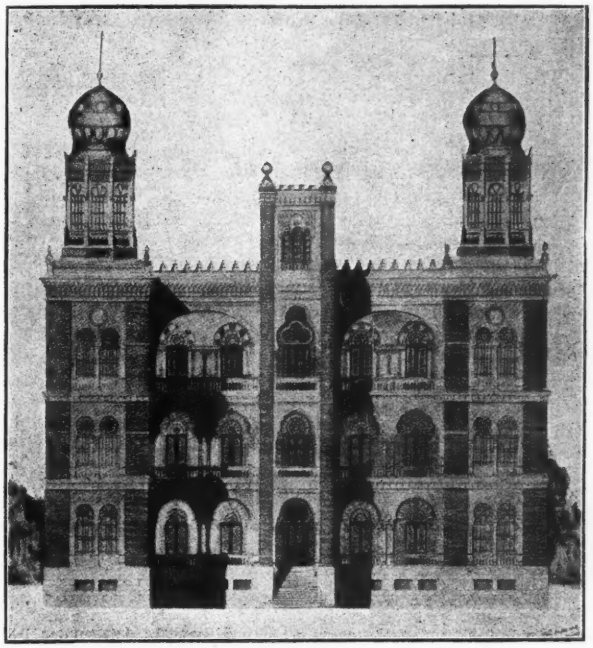
In August, 1904, it was determined to start building and in the meantime a small hospital, formerly known as The Nursery and Child's Hospital, in East Fiftieth Street, New York, was leased as temporary premises. This establishment was equipped for research in pathology, physiology and chemistry. Two years before Mr. John D. Rockefeller had set aside the sum of about £60,000 for the purchase of a site for the permanent building. The site was in Exterior Street, east of Avenue A. The frontage of the house was one hundred and thirty-six feet and the erection was five stories in height. The outside was pilastered façade of limestone and ornamental brick.

In the upper stories there were the general and special laboratories, research rooms and the usual accessories. On the roof were houses for laboratory animals required for the purpose of research. On the first floor were a large lecture theatre or auditorium, the library and study. An

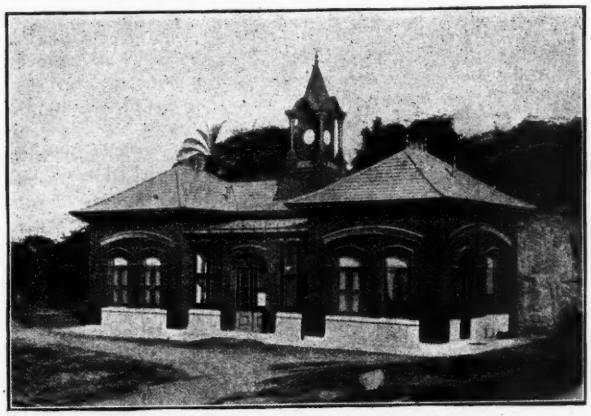
annex was attached to provide the animal houses and the power house.

While the building was in the course of erection, Mr. John D. Rockefeller recognized the need for further support and in 1905, he gave sums to bring the total endowment to about £200,000. In 1906, on the advice of the Board he provided money for the establishment of scholarships valued from £120 to £200 a year each. By this time the scope of the work was extending and very definite conceptions of the functions and methods of a research institute had been evolved. In October, 1908, the hospital which had been planned as an integral part of the scheme, was opened as an annex to the Institute. It comprised a main building with a *dependence* as an isolation block. The hospital was a seven-storied building. It was dedicated to Dr. Simon Flexner, as Director of the Rockefeller Institute for Medical Research, "in grateful recognition of the services rendered in the orderly and progressive scientific investigations which, sanctioned and encouraged by the Board and aided by learned associates and assistants, led him at length to the discovery of a cure for epidemic cerebro-spinal meningitis." The cost of the building was approximately £80,000.

In the same year the Institute sought and obtained a new charter by a special Act of Legislature, increasing the powers of the institution and enlarging the scope of its activities. The objects, as set out in the amended charter, were to conduct, assist and encourage investigation in the science and art of hygiene, medicine and surgery and allied subjects, in the nature and causes of disease and the method of its prevention and treatment and to make knowledge relating to these various subjects available for the protection of the health of the public and the improved treatment of disease and injury. The institution was empowered to use any means to those ends which from time to time would seem to it expedient, including research, publication, education, the establishment and maintenance of charitable or benevolent activities, agencies or institutions appropriate thereto and to aid any other such activities, agencies or institutions already established or which may hereafter be established.



Institut Oswaldo Cruz: Main Building.



Institut Oswaldo Cruz: Plague Laboratories.

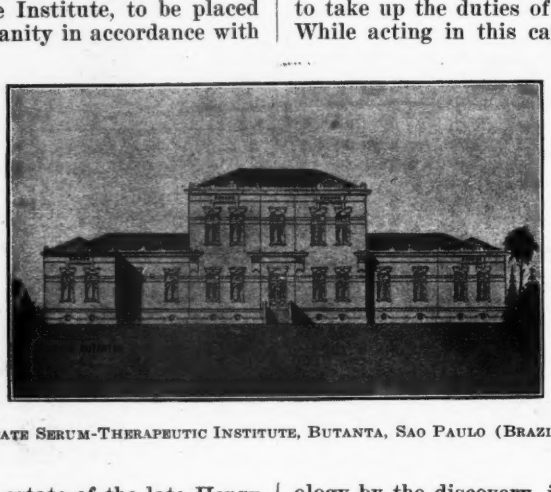
It should be pointed out that in the year 1896 *The Journal of Experimental Medicine* had been founded at the Johns Hopkins University and had fulfilled an important function in disseminating information concerning the investigations into the ætiology and pathology of disease. In 1905 this journal was taken over by the Rockefeller Institute for Medical Research and it has been issued from the Institute since that date.

In 1907 a farm was acquired with buildings, covering an area of about one hundred acres, in Clyde, New Jersey. On this ground there were sufficient buildings for the purpose of the breeding and care of animals for experiments. In addition, the produce of the farm was required for the Institute. Mr. Rockefeller demanded, when this farm was attached to the Institute, that the greatest care should be exercised in the use of animals for experiments, that there should be no unnecessary wastage of animal life and that pain should be avoided as far as possible. On the other hand, he recognized that it was essential to employ animals for research purposes aiming at the diminution of suffering and death of man and animals.

At this time, namely, 1907, the endowment was increased by a gift of £525,000, while in 1910 and 1911 further gifts of £730,000 and £185,000 brought the total up to £1,984,000. In this connexion it may be pointed out that Mr. John D. Rockefeller has given to the Rockefeller Foundation, which includes the activities of the Inter-

national Health Board, the immense sum of over £35,000,000.

The departments at the Institute are five in number. There is the Department of Pathology and Bacteriology, the Department of Chemistry, the Department of Physiology and Pharmacology, the Department of Experimental Biology and the Department of Experimental Surgery. The hospital is used to enable the members of the staff to study selected forms of disease under the most favourable conditions. The patients are admitted on the understanding that, while the best care and treatment will be accorded that science can provide and the dictates of humanity shall remain paramount, the disease from which they are suffering, will be the subject of investigation. No charge is made to any person treated in the hospital for professional care or for services rendered or for board and lodging. The members of the staff recognize that all discoveries and inventions made by any person in receipt of compensation from the Institute shall become the property of the Institute, to be placed freely at the service of humanity in accordance with the beneficent purposes of the founder. During the first year of its existence special studies of acute lobar pneumonia, acute anterior polio-myelitis, syphilis and certain types of cardiac disease were carried out. In each succeeding year a limited number of pathological processes have been chosen for particular investigation.



State Serum-Therapeutic Institute, Butanta, Sao Paulo (Brazil).

In 1913 the Rockefeller Institute for Medical Research benefited by a bequest from the estate of the late Henry Rutherford amounting to £40,000, the income of which is to be applied to the investigation into the causes and nature of the disease known as cancer and the methods of its prevention and treatment. In the same year Mr. John D. Rockefeller established a system of pensions for workers at the Institute. He set aside the sum of nearly £100,000 for this purpose. Members of the Institute staff retiring at the age of sixty-five years, after fifteen or more years' service, are entitled to a pension equal to three-quarters of their salaries, while those retiring at the age of sixty years receive from one-half to three-quarters of their salaries, according to the length of their service. Pensions are payable to members retiring totally disabled after ten years' service and to the widows and orphaned children of members. These pensions are reckoned at the half scale.

The library arrangements at the Rockefeller Institute for Medical Research are admirable and extensive. Closely related to the Library is the Publication Department. From it are issued *The Journal of Experimental Medicine*, edited by Simon Flexner, *The Journal of General Physiology*, edited by Jacques Loeb and W. J. V. Osterhout, and *The Journal of Biological Chemistry*, edited by Stanley R. Benedict, H. D. Daking, Lafayette B. Mendel and Donald D. Van Slyke. In addition, "Studies from the Rockefeller Institute for Medical Research" appear from time to time, as do the "Memoires." It is doubtful whether any research institution has ever worked under such favourable conditions. The scientific value of the work that has emanated from this great foundation has been recognized throughout the world.

DAS KÖNIGLICHE INSTITUT FÜR INFEKTIONSKRANKHEITEN.

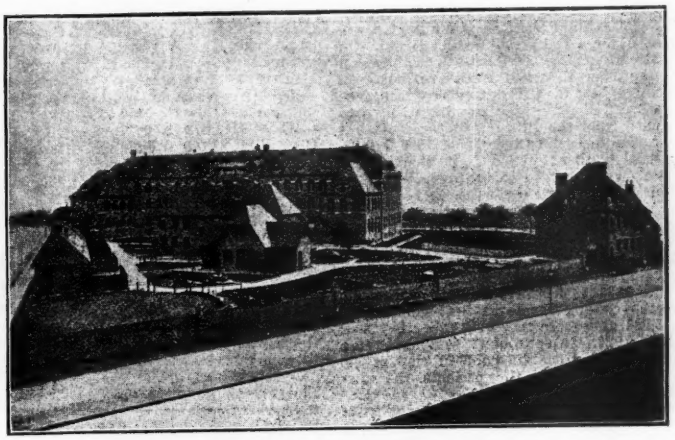
Robert Koch started his professional career as a general practitioner at the age of twenty-three. After six years he relinquished his general practice to take up the duties of a medical officer of health. While acting in this capacity he spent much time and energy in the investigation of wound infection, septicæmia and anthrax. These researches attracted considerable attention and as a result he was offered and accepted a position in the Reichsgesundheitsamt, in Berlin, a governmental institution for the control of public health.

While working in one of the laboratories of the public health department, he laid the foundation of bacteriology by the discovery, isolation and cultivation on artificial media of the tubercle bacillus. This discovery was announced in a publication in 1882. Eight years later he published his first work on tuberculin.

During the ten years spent in the public health department's laboratories, the conditions under which he conducted research, were of the simplest kind. Even his microscope was an indifferent instrument. The Prussian Government, recognizing the disadavantages of work in a public health laboratory, where routine necessarily took precedence over original work, determined to free him of the departmental restrictions and to place him in a position in which his genius might have free play. In 1891 a small building, previously used as a dwelling house, and a second building also used for another purpose were converted into a scientific institution and its hospital annex. These buildings were situated within the grounds of the Charité Hospital. The institution was called "Das Königliche Institut für Infektionskrankheiten" (The Royal Institute for Infective Diseases). It was

held that by associating the institute with the Charité Hospital the scientific investigation of infective diseases would be furthered and Koch would be placed in a favourable position for studying the means for the prevention and treatment of various contagious diseases. The annex served the purpose of bringing persons suffering from the diseases under investigation in close and suitable association with the laboratories. The staff consisted of workers well trained in bacteriology and chemistry and worked loyally and enthusiastically under the direction of Robert Koch. While the establishment was small and its equipment limited, the favourable environment fired the ambition of everyone concerned. The work became increasingly enterprising, with the result that within a brief period Koch and his staff had outgrown his miniature institute.

About this time the Charité Hospital needed more land for extension. In these circumstances it became apparent that a larger and more expansile home was needed for the institute. Robert Koch was consulted in regard to the plans of the new building and his experience and foresight led him to devise one of the best adapted of the early research institutes.



Das Königliche Institut für Infektions-Krankheiten in Berlin (Koch's Institute).

Late in 1901 the new institute was completed and was put into commission. It was situated in the north of Berlin, close to the Rudolf Virchow Hospital. It is a three-storied building with east and west wings. Apart from the main building, there is a hospital containing accommodation for one hundred and thirty-eight patients, a mortuary and *post mortem* house and the usual power house and other outbuildings. It was determined that the functions of the new, enlarged institute should be extended.

As before, the first object was scientific investigation of infective diseases. The list was augmented; syphilis, anterior polio-myelitis, several tropical diseases and others were added. In the next place, the programme included the inquiry into the processes of infection, the mechanism of immunity and many other allied problems. The Government demanded that the necessary examinations of suspicious material in connexion with outbreaks of infective disease should be carried out in the Institute and specific protective and curative sera and vaccines should be produced. In connexion with the diagnosis of these infective processes, provision had to be made for the dispatch of competent workers to any part of the country to investigate an outbreak of disease. It was further required of the workers in the laboratories to issue reports on material submitted for examination in connexion with public health, criminal law and similar matters. A special department for the application of Pasteur's prophylactic treatment of hydrophobia was included in the scheme. Lastly, the Institute was listed as one of the centres for post-graduate study in bacteriology and hygiene.

The Institute is divided into six departments, each of which is under the control of an expert. The Scientific Department is the largest and most important. Then there is a Department for Dangerous Infective Diseases; the third is the Department for the Study of Immunity; the fourth is the Department for Tropical Diseases; the fifth is the Rabies Department and the sixth is the Chemical Department. The Director of the Institute, assisted by the Secretary, has control over the whole administration and work. In each department there are full-time assistants, salaried and voluntary workers, as well as laboratory attendants and other non-professional employees. In pre-war time the annual subsidy amounted to about £15,000.

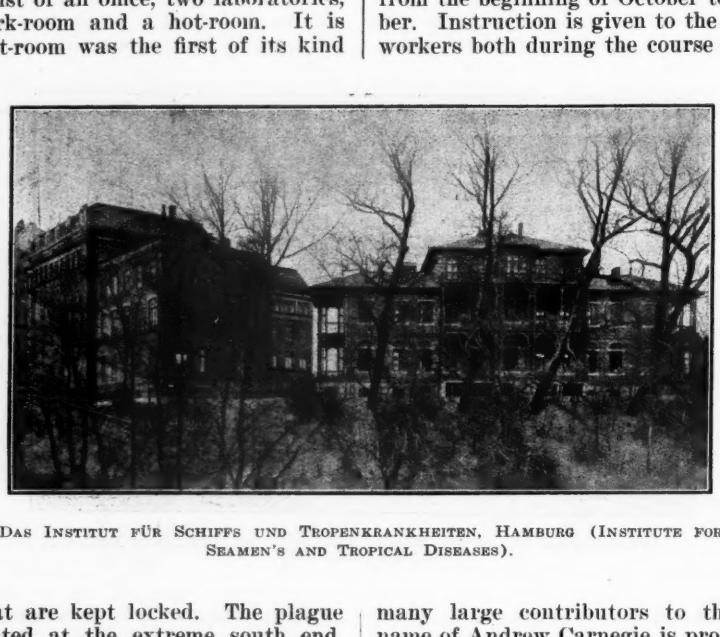
On the ground floor of the main building there is a large lecture theatre with anterooms for mounting of specimens and for the storage of specimens, charts, apparatus, slides and the like, required for lectures. In another room the so-called "flying laboratories" are housed. These consist of portable cases containing the necessary instruments, microscope, incubator with kerosene lamp, sterile glass ware, nutrient media and so on, ready packed, so that when a call comes, the medical officer charged with the duty need not waste time in collecting material. To the south there is a photomicrographic studio, with modern apparatus, dark room and well-adjusted electric and other forms of illumination. A very valuable collection of slides for the projection apparatus has been prepared in the course of time.

On the ground floor of the east wing there are the laboratories of the Chemical Department. In these and all other laboratories the tables, cupboards and cases are raised on feet, in order that the floor may be cleaned underneath. This department includes balance room, special laboratories for cleaning glass ware, for chemical work entailing mal-odourous material, for incineration and the like.

In the central part of the building on the ground

floor there are certain administrative offices and stores, private studies for the medical officers and so on. Leading from this administrative part is the Rabies Department, with rooms for the removal and preparation of the spinal cords for inoculation, rooms where the inoculations are carried out, laboratories and office.

The first floor contains a large laboratory for graduates and others taking the bacteriological course. This room has eleven windows and in front of each there is a bench for two workers. In an adjoining room specimens are prepared and in case of need a few persons attending the course are given benches. On the east side there is a laboratory for the study of protozoa, an office and several work-rooms. On the same floor there are the laboratories used by Robert Koch, which are now reserved for research into the problems connected with tuberculosis. They consist of an office, two laboratories, an attendant's work-room and a hot-room. It is stated that this hot-room was the first of its kind provided with reliable heat regulation and efficient insulation. Attached to each laboratory are rooms for washing up soiled glass ware, rooms with autoclaves, steam and dry air sterilization apparatus and similar plant.



Das Institut für Schiffs und Tropenkrankheiten, Hamburg (Institute for Seamen's and Tropical Diseases).

On the second floor the Department of Dangerous Infective Diseases is separated from the rest of the Institute by heavy doors that are kept locked. The plague laboratory is situated at the extreme south end. It has terrazzo flooring and enamelled walls and ceiling. Flies and mosquitoes are excluded by nickel wire net protection outside the windows. The tables and benches are made of glass and composite material, with brass fittings, capable of rapid and effective sterilization. The doors are double. Next to the plague laboratories is the cholera laboratory and next to it is the glanders laboratory.

The other part of the second floor is taken up by the library and the librarian's office, as well as the laboratories of the Scientific Department, including the museum.

The third floor contains the photographic rooms and other offices.

The hospital contains one hundred and thirty-eight beds, distributed in six pavilions. It is under the management of the Director of the Rudolf Virchow Hospital. Patients suffering from scarlatina, diphtheria and pertussis are admitted to special wards, while separate isolation is reserved for the rarer forms of infective disease, such as variola, cholera and so forth. An observation ward is provided for patients suffering from infections the diagnosis of which is uncertain at the time of admission. Each pavilion has its own operating theatre.

The mortuary is well planned. It contains bath rooms for the pathologists and attendants, a large *post mortem* room, a small *post mortem* room for plague, laboratories for bacteriological work and the mortuary proper. The waste water from the *post mortem* rooms is conducted into a disinfecting basin.

The post-graduate courses take place each year from the beginning of October to the end of December. Instruction is given to the voluntary and paid workers both during the course and throughout the year. By arrangement in pre-war times special courses were given for army medical and veterinary officers.

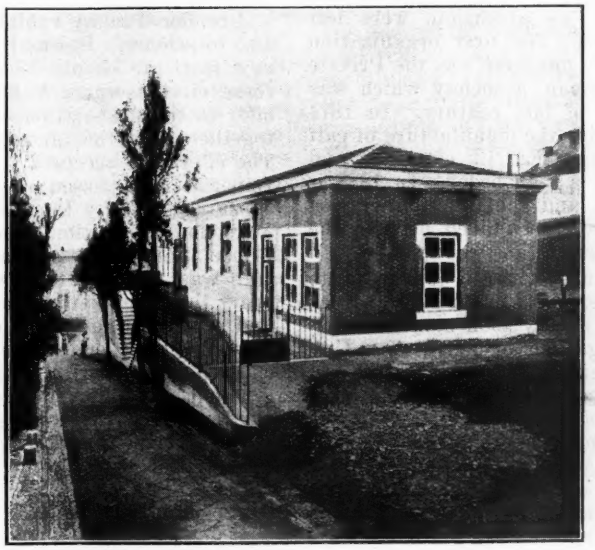
Mention should be made of the Robert Koch Foundation for the Combating of Tuberculosis. This was established on the occasion of the twenty-fifth anniversary of the discovery of the tubercle bacillus. Among the many large contributors to this foundation, the name of Andrew Carnegie is prominent.

DAS KÖNIGLICHE INSTITUT FÜR EXPERIMENTELLE THERAPIE, FRANKFURT AM MAIN.

The origin of the great institute of experimental therapy in Frankfurt (das Königliche Institut für experimentelle Therapie), like that of many others of renown, was rather of a personal nature than of a strictly academic one. Paul Ehrlich, the great master of immunology and chemo-therapy, has laid the foundation of the modern doctrines of the processes of immunity and had introduced to the world of medicine the first and the most logical conception of stereo-chemistry in its relations to resistance to disease. It was consequently held to be a matter of practical importance that every facility should be given to him to prosecute his researches under

the most favourable conditions. At the same time the need for a recognized institute where therapeutic sera could be standardized by an independent authority was felt. The Ministry of Education of Prussia determined to establish a research institute in Frankfurt, having for its object the official testing of therapeutic sera coming under State control, the carrying out of bacteriological and hygienic work for the hospitals and for the medical profession of Frankfurt and for the development of the doctrines of immunity. The institute was completed in the year 1899. At first there were three departments, the testing, the bacteriological and hygienic and the biological departments. Somewhat later a fourth department was added on a private endowment, namely, the department for the study of cancer. In 1910 the bacteriological and hygienic department was separated from the institute and was continued as a municipal establishment. Lastly, a veterinary department was added to the institute proper.

The buildings in the Paul Ehrlich Strasse, to the south of the city, are situated in close proximity to the large municipal hospital. It consists of a main building and two animal houses. The ground floor of the main building contains the private studies and laboratory of the Director, the laboratories for the testing of sera and a library. On the first floor there are two laboratories and a reading room for work in experimental biology, a laboratory devoted to physico-chemical work, another reserved for technical testing work and the quarters for the veterinary scientific work. On the second floor there is one large laboratory belonging to the cancer research department and a smaller room for the keeping of inoculated mice. Apart from the laboratories and rooms mentioned, there are cold and hot rooms, rooms for the washing of glass ware, rooms for the preparation of media and the like. The refrigerating plant is placed in the basement. The cold rooms are kept at — 10° C., in order that sera, organs and tissues may be kept for long periods in a frozen condition.



Hôpital de St. José, Lisbon: Bacteriological Institute.

The testing of sera has been worked out with scientific accuracy by the setting up of standard sera against which samples can be evaluated. It will be remembered that Paul Ehrlich was the originator of the unit of immunity as a definite measurement for antitoxic sera. He found that toxins could not be employed for this purpose, as their potency was inconstant and they could not be conserved as standards. Antitoxins, on the other hand, could be kept in a dry condition *in vacuo* without any variation of potency for indefinite periods. The greatest care is taken to standardize every new batch of standard sera against the existing standard sera, so that the unit may remain constant. Test toxins are constantly being made. They are used as control standards for samples submitted. Antitoxic and anti-bacterial sera and tuberculins are handled in the same way. Each sample is tested first of all for its purity, by which is meant absence of precipitates or cloudiness, freedom from bacteria, freedom from toxin, while the phenol content is not above 0.5% and the albumin content is not above a definite level fixed for each class of serum. In the next place, the samples are tested for their immunity value. Diphtheria antitoxin is standardized in a relatively simple manner. Some other antitoxic sera have to be evaluated by means of a very complicated procedure. The anti-bacterial sera are tested for their power to protect laboratory animals against known and measured quantities of infecting material. Tuberculins are tested for their specific toxicity for tuberculous guineapigs and their action is compared with that of standard tuberculin. In this department researches on the therapeutic activity of sera are carried out, as well as studies in connexion with hypersensitiveness to serum.

In the department of experimental biology the scientific investigation of immunity processes occupies the first place. A great deal of work on the complement fixation reactions of Wassermann and others has been conducted. Precipitin work, the investigation of the various cytotoxins and other animal toxins, including snake, spider and scorpion venoms and the study of many other biological reactions have been productive of valuable results since the establishment of the department.

The cancer research department has long occupied one of the leading places in the world. It was here that Bashford, the first director of the Imperial Cancer Research Fund, of London, received his training. Much pioneer work was conducted in the early stages, while in later years up to the beginning of the war Ehrlich and his staff contributed many important data to the knowledge of the immunity processes connected with mouse carcinoma.

Students, graduates and others are admitted as voluntary workers in the institute. The staff comprises a Director, three heads of departments, a

veterinary pathologist, two assistants and two technical assistants. The cancer research staff is kept separate and includes four or five assistants who work under the Director.

THE INSTITUTE FOR RESEARCH OF INFECTIOUS DISEASES IN TOKYO.

Western ideas have gradually spread to the east. While the revival of the one-time culture of the Celestial Empire is halting and little spontaneous there has been a rapid development in Japan, the result of an extraordinary determination of the intelligent classes to attain the same intellectual level as the people of the western races. In education, in the applied sciences, in academic achievements, in industry and in music this movement toward the western ideals has been noticeable during the past half century. At first hygiene and social medicine, as well as education, were left largely in private hands. The first organization concerned with preventive medicine was the Private Health Association of Japan, a society which was founded in the 'eighties of last century. In 1874 there was an institution for the manufacture of calf lymph, but it would seem that its efficiency and reliability were never of a high order. In 1888 it went out of commission and the function of preparing Jennerian vaccine was handed over to the young Private Health Association of Japan.

In 1887 Dr. Shibasaburo Kitisato journeyed to Europe and studied bacteriology under Robert Koch in Berlin. His unusual ability soon manifested itself in numerous investigations of merit. The University of Berlin, recognizing the value of the aid that Kitisato gave to Robert Koch, clothed him with the titular distinction of Professor. He returned to Japan in 1892 and immediately undertook single-handed some important researches into the nature of microbic diseases. A wealthy merchant, Yukichi Fukuzawa, became interested in his enterprise, industry and genius and immediately placed a small building at his disposal. In addition, Fukuzawa provided the necessary funds for prosecuting the researches. About this time the Private Health Association of Japan (Dai Nippon Shiritsu Eisekai)

Institute for the Research of Infectious Diseases, Tokyo: General View.

determined to found an institute for the study of infective diseases. It was recognized that Kitisato had rendered many vaulable services to his country and to science. It was therefore proposed that the new institute should be directed by Kitisato. In these circumstances Fukuzawa måde the generous offer to the Association of the gift of the building, together with the land on which it was situated. The offer was accepted. In the following year the Imperial Diet passed a special measure granting a subsidy of twenty thousand yen (about £2,000) toward the foundation fund and an annual sum of fifteen thousand yen as an endowment. The institute was removed to new quarters and for seven years the organization was continued under modest and somewhat restricted conditions as a State-supported private endeavour. In 1899 a change was effected. The institute was taken over by the Government and in the succeeding years its accommodation and activities were greatly extended. In 1896 the Government had established two laboratories for the preparation of calf lymph, the one at Tokyo and the other at Osaka. The latter had but a brief existence. Some time later the Tokyo laboratory was placed under the management of Kitisato. In 1905 this establishment was merged into the Institute for Research of Infectious Diseases.

Under the State control the new institution, which is situated in the south-west extremity of Tokyo, acquired increasing importance. It grew in stature and in fame and, although it has been planned on western lines, it has preserved its own characteristics and local traits. In the first place, it comprises a number of separate buildings, the majority of two stories. Even the administrative officers, dignified in accordance with Japanese custom with the title of department, are housed apart from the rest of the institute.

The objects of the institute are clearly defined in the functions of each of the six departments. The first department exists for the investigation of the causes of infec-

Institute for the Reseach of Infectious Diseases, Tokyo: Main Building.

tive disease and of the means for preventing their spread. This department is scattered throughout several buildings. In the main building on the ground floor the heads of the departments have their laboratories and studies. There is a board room and a library. The latter is of fireproof construction. On the upper floor there is the Director's study and laboratory, studies and laboratories of other heads of departments and a museum containing cultures of pathogenic bacteria and protozoa, collections of pathological specimens, insect vectors, models, instruments and apparatus.

In the second building are placed the laboratories and rooms for the rabies work, the laboratories of the chemical section and several rooms for the preparation of therapeutic sera. Each serum has its special room. The culture medium preparation is carried out in this building in a special laboratory.. There are also rooms for steam and dry sterilizers.

The animal house is in three portions. One house is provided for mice, guinea-pigs, rabbits and dogs, while a second is reserved for sheep and goats. A third, completely isolated house is kept for cats, monkeys and apes. In one of these houses there is a section for photography, with a modern photomicrographic equipment. The plague laboratories are four in number, which, together with a disinfecting room and an animal room, are contained in a separate building. The section is adequately protected against flies and mosquitoes by wire netting; all the floors are of cement and the tables and benches are of glass.

The special building reserved for instruction in bacteriology is situated to the south-west of the plague laboratory. This comprises the second department of the Institute. It is a two-storied building. On the ground floor is a large lecture theatre capable of being rendered dark for the use of the epidiascope. Adjoining the platform is a fine bust of Kitisato, the gift of Prince Konoye and other public-spirited citizens, in recognition of the Director's services to his country in 1894, when he investigated an outbreak of plague in Hong-Kong. On the upper floor are the laboratories and class-rooms.

The serum department, the third on the list, contains stables with stalls and loose boxes for two hundred and three horses and ample paddock for exercise and the building for the bleeding of the horses and the separation of the serum. The lymph preparation laboratories and stables for the accommodation of ninety-eight calves comprise the fourth department. Associated with these departments is the refrigerating plant, which is also in a separate building. In the same building there are rooms for the bottling of serum and for the packing of serum and vaccine.

The fifth department embraces the treatment of infective diseases. It is situated within the hospital. There are two wards with beds for fifty patients. Each ward is subdivided into large and small sections. In addition, there are examination rooms, an operating theatre, disinfecting rooms, kitchens, bath-rooms and other offices and the medical officers' studies. The out-patient department has a branch for the preventive treatment of hydrophobia and another for *Kakke* (beri-beri).

The last department is the administrative. It, too, possesses its own building. The Institute has an incinerator or crematorium for the destruction of dead animals and infected materials of divers sorts. Apart from the other buildings is the dining hall and in its neighbourhood the quarters of the medical officers and other members of the staff.

There are two branch laboratories. The first is for the collection and preparation of snake venom and antivenin. It is situated at Nase, on Ishima Island. The second is at Chemulpo, in Korea, and is used for the preparation of calf lymph.

The income of the Institute is derived partly from sums voted by the Imperial Diet and partly from the sales of sera and vaccine and students' fees. In an average year it amounts to about £32,000. The Institute for Research of Infectious Diseases has secured for itself a high place among the famous research establishments of the medical world. It is picturesque, well planned and adequately equipped, but none of these qualities would secure for it its reputation. Shibasaburo Kitisato once said that he was not interested in good equipment of a bacteriological institute; he was concerned in the quality of the work conducted in the laboratories. The quality of the work at the Tokyo institution is of a high order.

The Defence Medical Services.

During the Great War the medical profession in Australia was true to its traditions. The requirements of the forces were met, notwithstanding the temporary embarrassment in the civil arrangements at home. Should the medical profession receive another call, there will be no lack of enthusiasm, no failure of loyalty. It is therefore necessary for every medical practitioner to remember that he has a special obligation to his country to prevent difficulty and disaster in the time of need. The disarmament proposals of the Washington Conference wear a strange and artificial garb at present, when the British Navy alone of all the navies of the world is being reduced and when the British Army, but not the armies of the other great powers, is being kept at a level below the mark of security. The proposal has been made to combine the medical services of the three Defence Forces, so that their efficiency may be maintained at a cost lower than that needed for keeping three branches struggling against insuperable difficulties. Up to the present this proposal has not been adopted, although it has strong support and weighty argument to back it. The Defence Medical Services are languishing and in a few years will be reduced to relative ineptitude unless the authorities awaken to the realization of the danger of a reversion to the conditions of the pre-war days.

THE NAVAL MEDICAL SERVICE.

The Royal Australian Naval Medical Service still offers employment to a handful of medical practitioners. Candidates for appointment must be not less than twenty-one years and not more than thirty-eight years of age. They must be British born and must be registered medical practitioners in one of the Australian States or entitled to registration. Testimony of character will be required. On joining the candidate is given the rank of Surgeon-

Lieutenant on probation. After twelve months his rank is confirmed. His pay on joining is twenty-eight shillings a day, with five shillings deferred pay. After three years he receives thirty-two shillings a day and an extra ninepence deferred pay. At the end of six years the officer is promoted to the rank of Surgeon-Lieutenant-Commander, provided that he has spent two years at sea and that he is recommended for promotion for the Director of Naval Medical Services. The pay is then increased to thirty-eight shillings a day and the deferred pay is increased to six shillings and sixpence a day. After three years the pay is further increased to forty-three shillings a day, while the deferred pay is brought up to seven shillings a day. After six years' service as Surgeon-Lieutenant-Commander and twelve years in the Navy the officer may be promoted to the rank of Surgeon-Commander. To attain this rank he must have served at sea for two years as Surgeon-Lieutenant-Commander, he must have passed the qualifying examination, he must have been recommended for promotion by the Director of Naval Medical Services and he must show that he has not declined service except for reasons acceptable to the Naval Board. He is paid forty-eight shillings a day at first and eight shillings a day are allowed to accumulate as deferred pay. This pay is increased after three, six and nine years. After nine years, when he will have been in the Naval Medical Service for a period of twenty-one years, his pay will be three pounds a day and his deferred pay ten shillings. In other words he will be earning £1,277 14s. a year and will be drawing £1,095. A Surgeon-Captain receives sixty-five shillings a day with eleven shillings and threepence deferred pay, and in the course of nine years the pay is gradually increased to four pounds a day. The deferred pay remains at eleven shillings and sixpence after three years' service as Surgeon-Captain.

Officers on joining are granted a uniform allowance of fifty pounds. When the officer is on leave he is allowed one shilling and ninepence a day ration allowance and when on detached service three shillings a day. Lodging allowance may be granted to officers when on shore. Deferred pay may be payable in exceptional circumstances with the sanction of the Naval Board, but it is to be held as a rule until retirement or death. Officers may resign their commissions by giving three months' notice in writing. The resignation will not be effective until it has the approval of the Governor-General.

Information concerning provision for promotion, hospital study, furlough, leave of absence and compulsory retirement, *inter alia*, was published by the Director of Naval Medical Services in The Medical Journal of Australia of May 6, 1922 (pages 479 to 484). Medical practitioners interested in the details are recommended to consult this article.

THE ARMY MEDICAL SERVICE.

The Permanent Medical Services of the Army now comprise a part-time Director-General of Medical Services and three members of his staff, while the Citizen's Forces are also greatly reduced. The District staffs are composed of the six part-time Deputy Directors of Medical Services and the part-time medical officers of the Regimental Medical Establishments, of the Light Horse Ambulances, of the Field Ambulances and of the Australian Army Medical Corps Companies. The Deputy-Directors of Medical Services receive remuneration from £200 to £500, according to the Military District. There is also a part-time Assistant Director of Hygiene. Part-time medical officers are in charge of the Sub-Districts, of which there are fourteen. The medical officers of the Regimental Medical Establishments, spread throughout the six Military Districts, number one hundred and thirty-seven in all. These officers are attached to the Australian Army Medical Corps Companies. The Light Horse Field Ambulances carry five medical officers, while the Field Ambulance has six. The Sanitary Sections have one medical officer each. There are nine in all. Lastly, there are the part-time Area Medical Officers, whose remuneration is now £85 a year. The areas have been enlarged since the termination of the war. In addition, the special Reserve of the Australian Army Medical Corps exists for medical officers who have previously held commissions in the Army Medical Services and for others who are willing to become medical officers in time of need. The Reserve contains a surgical and medical staff required to give the treatment to the sick and wounded of the Australian Military Forces in time of war.

The pay of Lieutenant (trainee) is fifteen shillings a day, with a maximum of £12 a year. That of Captain is one pound two shillings and sixpence a day, with a maximum of £18 a year; that of Major is thirty shillings a day, with a maximum of £24 a year; that of Lieutenant-Colonel is thirty-seven shillings and sixpence a day, with a maximum of £30 a year. The medical officers have to undergo eight days' continuous training and eight days of whole and half day parades in order to earn these salaries. Further information concerning the Army Medical Services can be gathered from the article contributed by the Director-General of Medical Services in the Education Number of May 6, 1922.

THE AIR FORCE MEDICAL SERVICE.

The youngest branch of the Defence Forces also has its important medical service. The Royal Australian Air Force Medical Service is under the control of the Senior Medical Officer. Admission to this service is open to medical practitioners under twenty-eight years of age. They must be of European descent and sons of natural British subjects. They must be willing to fly when called upon and to qualify in aviation tests. The ranks are Flying Officer, Flight Lieutenant, Squadron Leader, Wing Commander and Group Officer. The remuneration is approximately the same as that of Naval Medical Officers. This service is especially fascinating and, since it appears to be closely associated with civil aviation, it offers many new problems to the young medical officer. Those who feel the attraction of the air and its associations, should apply to the Senior Medical Officer for fuller details of the career.

Membership of the British Medical Association.

Students on graduation are strongly advised to join the British Medical Association. In addition to the other privileges pertaining to membership, members receive *The British Medical Journal* and The Medical Journal of Australia.

The subscription of members of the New South Wales Branch is five guineas *per annum*. Members pay three guineas within the first three years of graduation. The same subscription is paid by those who have retired from active practice or who have reached the age of seventy-five years. Permanent whole-time medical officers of the various public services pay four guineas *per annum*. In the case of two members being husband and wife residing together, the joint subscription is two guineas less than the total sum of their subscriptions would be if paid separately.

In the case of the Victorian Branch the annual subscription for town members is four guineas and for country members three and a half guineas. Junior members pay two and a half guineas.

Town members of the Queensland Branch pay an annual subscription of five pounds. Country members pay four pounds and junior members pay two pounds ten shillings.

In South Australia members of the Branch residing in Adelaide pay an annual subscription of four pounds five shillings. This entitles them to use the University Library. Country members pay three pounds fifteen shillings and graduates of the Adelaide University of less than three years' standing pay three guineas.

In Western Australia the annual subscription of members of the Branch residing in the metropolitan-suburban area is four guineas; that of country members is three guineas, while junior resident members of public hospitals are admitted to membership for two guineas *per annum*.

The annual subscription for membership of the Tasmanian Branch is four guineas.

The Medical Journal of Australia

SATURDAY, APRIL 14, 1923.

Research.

The plan on which the Education Number of The Medical Journal of Australia is constructed each year differs from the more orthodox scheme by the selection of one of five different aspects of medical activity as the chief theme. In this way tedious repetition of the same matter with minor alterations is avoided and the reader is given information that should be of interest and help not only to those standing at the threshold of their career, but also to those who have advanced some way on the road. The chief theme in this issue is medical research. It must be remembered that medicine has been built entirely on patient investigation of the structure and functions of the body in health and of the nature and causes of disturbances of health. The empiricism of yore has gradually given place to the exact knowledge of to-day as the result of scientific work. The practitioner is apt to forget that his daily task of examining his patients, of discovering the nature of their affections and of applying some form of rational treatment has been rendered possible by scientific study. The rebuke that some of the matters subjected to investigation are of academic interest is unjustified, since the application of knowledge to practice follows when the significance of the facts elicited is understood.

In this issue are published articles from the pathological laboratories of the Commonwealth and from the departments of anatomy, physiology and pathology of the medical schools. These articles have been contributed by special request by the responsible practitioners. The thanks of the profession are due to these gentlemen. Invitations were addressed to the Deans of the Faculties of Medicine to contribute articles on the facilities offered for research into the manifestations of disease from the clinical aspect. A sad story has to be told. No facilities exist in any part of Australia for this form of investigation. Medical practitioners who desire to devote energy and intelligence for the furtherance of knowledge of disease as it is observed in patients under their care, have to create facilities for themselves. The medical schools, at all events as far as clinical medicine and surgery are concerned, exist for the preparation of students for examinations, not for their education in science and not for the furtherance of knowledge.

There are many members of the medical profession who regard research as something to be left to the idealist, the individual who has time and energy to waste. They have no time for study or research after a busy day of general practice. The position of the research worker has not been defined in the scheme and his remuneration is usually quite inadequate. The patient is prepared to pay his medical attendant for services rendered during illness. It is no one's business to provide payment for the investigator on the result of whose labours the practitioner has to rely.

It will be seen from the articles contained in this issue that there is no scheme of research in Australia and that in the absence of a comprehensive organization, there can be no stimulus to competent practitioners to devote time, ingenuity and energy to this very important function. The history of research and the experience of all nations teach quite clearly that a satisfactory position will not be obtained until a well-considered plan has been evolved. The work is difficult and not every graduate in medicine is competent to undertake it. A special spirit of inquiry, of imagination and of patient optimism is needed. In addition, training in technique is essential. The State usually employs research within narrow limits for particular problems. The results of any given investigation may not become apparent for a long time; indeed, some excellent pieces of work have resulted in the establishment of detached facts which have no apparent and immediate application. Again, the State usually demands the untenable condition to its subsidy of determining the problems to be investigated. A research student must be untrammeled by the demands of political masters. Again, the history of the Medical Research Council reveals that, even

under very favourable conditions, the State makes a bad employer. There is a tendency to embrace in the State scheme all the existing agencies and private undertakings, with the result that independence is sold for a small financial gain. It might be argued that Robert Koch and Paul Ehrlich carried out their pioneer work while engaged at governmental institutions. The reply is that in the British Empire freedom from State control is valued at a high price. Furthermore, the State control in Australia and in the mother country is influenced too much by men who have commercial but no scientific understanding.

If the research scheme should be emancipated from governmental control, it follows that it must rely on private endowment or be absorbed in the general programme of medical education. The soundness of the organization of the Rockefeller Institute for Medical Research demonstrates the advantages of private endowment. Its application, however, is impracticable unless multi-millionaires are prepared to hand very large sums of money over to a committee of competent persons to utilize for the benefit of humanity. Australia's commercial magnates have revealed no incliniation to endow medical research on a large scale. It must be remembered that the Lister Institute of Preventive Medicine, with an endowment of nearly one-third of a million pounds sterling, has not solved the problem. The salaries paid to the highly trained and skilled medical practitioners occupying positions as assistants are so small that only men of means or philanthropists who are satisfied to sacrifice comfort and provision for old age for the fascinations of science, are tempted to enter the service. The Medical Research Council expends £130,000 a year and yet there is no regular career of research in Great Brtiain. If medical research be handed over to the medical schools as a proper function of the teaching bodies, the universities should be made to recognize that the best equipped men and women for the work cannot be attracted save for a short period unless provision is made for advancement step by step, with corresponding pecuniary compensation.

Since good work is more valuable than elegant buildings and fine equipment, the first consideration in a sound scheme must be that of adequate remuneration according to experience, ability and position. In all walks of life the youngster starts at the bottom of the ladder and earns a bare living wage until he has become proficient. After the apprenticeship stage comes that of the junior assistant. The young man is encouraged in other branches of occupation to render good service, so that he may earn a steadily increasing emolument. Then he passes to the position of senior assistant and thence to assistant manager of a branch or department. Eventually he reaches a coveted office as head of the branch or department and if his ability, diligence and enterprise be unusual, he may climb to the top of the ladder, the directorship of the institution. Exactly the same should apply to the man engaged in medical research. He should enter as apprentice with the determination that he has selected research as his permanent calling. He should be able to calculate the rate of his advancement, provided, of course, that aptitude and keenness are not wanting. He should know that, if he escapes the undoubted hazards surrounding a life spent among deadly bacteria and protozoa, he and his family may spend the evening of life in relative comfort. Any scheme of research that neglects this aspect of the problem is unsound and short-sighted. The next condition that should claim consideration is the provision for coordination in the work. The tragedy of research lies largely in the waste of energy resulting from isolated work. Bricks, mortar and equipment come next. They are very important, but since they have a definite marketable value and are always available, their importance cannot compare with brains and genius. The majority of the great research institutes of the world have either been placed in association with a large hospital or have possessed small hospitals of their own where patients may receive gratuitous medical and surgical attendance and in return provide the opportunity of studying the illnesses from which they are suffering. In the last place, the library must not be forgotten. Science is international and every worker must be in a position to know of all the work that has been carried out on the subjects of his own researches.

Australia is under a grave disability in that the

provisions for research in medical problems are quite inadequate. These provisions compare unfavourably with those in other countries. We have the men with brains, but no money wherewith to retain their services. We have some laboratory accommodation and some equipment, but those in charge of the laboratories, with but few exceptions, have so much routine work to do that they can neither conduct research work properly nor teach technique to others. There is only one difficulty—the lack of money. Everyone must admit that the most important work that can be conducted is that leading to the discovery of the cause and prevention of disease, since health is the most precious possession of mankind. When our wealthy citizens recognize the truth of this assertion, as Mr. John D. Rockefeller has done at the other side of the Pacific Ocean, this disability will disappear and medical research may be established in the Commonwealth on sound and promising lines.

THE BRITISH MEDICAL ASSOCIATION.

Each year we publish in the Education Number an article calling attention to the advantages of membership of the British Medical Association to medical practitioners. The education of a medical practitioner begins when he enters the medical school and commences his professional studies. It ends when he relinquishes medical practice. It must be recognized that the medical student will learn rudiments, the scientific basis of medical knowledge, the application of scientific data to clinical work and some technical details concerning the treatment of disease in human beings, but he will learn more in the world of experience, provided that the foundation has been well laid. In particular, he will gain in the course of years the opportunity of studying men and women and the relationship of their minds to their bodies. At the medical school he is given lessons on the ethics of his profession, but he will need assistance and guidance when he comes to apply these principles. His continued education will follow partly through his unaided endeavours and partly by watching the behaviour and writings of others. Just as he will have to read without interruption, if he would keep himself abreast of the times, so he must be prepared to rely to some extent on his colleagues if he would escape the pitfalls that may entrap the unwary and unprepared. Moreover, he has a duty from the moment that he enters the profession of medicine to assist in maintaining the honour and dignity of that profession and as far as lies in his power to contribute to the sum total of knowledge that is the common lot of his compeers.

The British Medical Association exists for these purposes. It is not a trade union, organized to establish a minimum wage and limited hours of labour. It is not part of the function of the British Medical Association to compel its members to refuse employment save when the award rates are paid. The constitution does not permit the executive to employ coercion or compulsion on its members; not one penny can be used of the funds of the Association to compensate members for loss of income arising out of a withdrawal from employment. In short, the British Medical Association has a constitution specifically preventing its members from adopting measures which, if carried into effect, would render it a trade union.

It is an Empire-wide organization, founded long ago to unite the medical profession, to maintain the honour and interests of that profession and to advance medical knowledge. It has its headquarters in London and its ramifications in all parts of the British Empire. The government of the Association is vested in the Representative Body, which sits once a year or more often for the purpose of considering all matters affecting the profession and its relations to the public. For convenient arrangement the members residing in a defined area are grouped to form a Division, while in certain situations several Divisions the areas of which are contiguous, are grouped to form a Branch. The Branches in Australia are constitionally Divisions and are often termed Branch-Divisions. The Representative Body comprises representatives of the Divisions or Branch-Divisions. In matters of policy each representative has one vote, but if a representative demands a card vote and is supported by nineteen other representatives, each representative records as many votes as there are members in his electorate.

The executive of the Association was formerly called the Central Council, but is now known as the Council. In the intervals between the Representative Meetings the Council and the standing committees which are appointed from the Representative Body, carry on the work of the Association. Each year a meeting of the Association is held in one of the larger cities of the United Kingdom. This Annual Meeting is a congress and the work is of a scientific nature. In addition, the Divisions are organized so that regular meetings may be held at which scientific matters may be discussed, papers on professional matters may be read and medico-political problems may be considered. In the United Kingdom the Branches do not hold general meetings. The Divisions have their committees, with chairman, secretaries and other office-bearers. The Branches have Councils whose functions are defined in the Articles and By-Laws.

In Australia the Branches are controlled by Councils with executive power. All questions of policy are considered in the first place by the Councils and before a definite regulation can be introduced or a policy adopted, the matters must be determined by the members in general meeting. As has been pointed out on many occasions within recent times in these columns, the Branches have gained permission in 1921 to seek incorporation under local laws. An incorporated Branch under the new rules would be enabled to carry out all the functions of the parent Association, but could not undertake any activity or action that the latter cannot undertake. The Branch Councils serve four important purposes. In the first place, they make arrangements for the holding of meetings at which scientific papers are read and clinical demonstrations are held. Closely associated with this function is that of the organization in conjunction with other bodies of post-graduate courses. The second activity is the development of hygiene and preventive medicine. In some instances the Council or a committee of the Council investigates problems affecting the public health and its protection and seeks to initiate legislation, to influence the administration of the public health laws or to carry out within the medical profession measures calculated to promote the well-being of the community. Some Branches have special sections for the study of problems connected with the prevention of disease. The third channel of activity of the Branch Councils is to secure by recognized means satisfactory conditions of contract practice and of salaried employment by public or private institutions. In this endeavour the members collectively agree on the terms and the Councils carry on negotiations with the object of convincing the contracting party or employing institution of the advisability of adopting the conditions. In contract practice the medical profession is prepared to give medical attendance in return for a small sum paid at regular periods by persons who are not in a position to meet the irregular and often considerable expenses associated with the treatment of illness when it arises. In other forms of salaried employment, such as is provided by Government departments, the remuneration and conditions of service are usually less satisfactory than those of private practice. In order that discontent and inefficient work may be eliminated, the Branch Councils seek to introduce reasonable remuneration with sufficient free time for recreation and study. The last function of the Branch Councils is concerned with the maintenance of the dignity of the profession. The ethical standard adopted by the British Medical Association throughout the Empire is a high one.

It will thus be seen that there is every reason why the young graduate in medicine should join this organization. It has much to offer to all. Its methods have been elaborated in the course of years and with the careful consideration of many of its ablest members. It provides continued education in professional matters; it affords to its members an initiation into the important field of preventive medicine; it protects the individual practitioner from the sweating systems of certain friendly society lodges and other organizations requiring the services of medical practitioners on a contract basis and finally it guides its members to guard the honour of the profession. In addition, membership of the Branches of the British Medical Association is very pleasant in bringing medical practitioners in contact with one another and thus fostering a spirit of friendship and camaraderie.

Medical Education in Australia.

Perhaps the most important decision that has to be made in life is the choice of a calling. In the majority of instances this choice has to be faced when the boy or girl is young and not fully developed. Ability, mental equipment and taste may change during adolescence and by that time it may be too late to alter the decision. Parents should be sure that their children are temperamentally, physically and intellectually fitted for the career before they enter them for the curriculum of medicine at one of the universities. The boy or girl must be permitted to have some say in the choice, but allowance should be made for impulsive tendencies uncontrolled by knowledge of the actual conditions and unchecked by a consideration of the prospects of success. Parents should therefore make the fullest inquiries concerning the profession of medicine before they assent to this choice for their sons or daughters. When the choice is made, there is still a further matter that has to be considered. It is the selection of a medical school. Three of our universities have medical schools. All are well founded and equipped and in all first-class teaching is available. There is no need to look to the old seats of learning in the mother country for adequate training. Our own schools may be utilized with confidence.

THE MEDICAL SCHOOL OF THE UNIVERSITY OF SYDNEY.

The University of Sydney has possessed a Medical School since the year 1883, although the full medical curriculum was first established in 1889. Since that time the school has grown by leaps and bounds and has developed into a great modern institution through the genius of the late Thomas Anderson Stuart. The curriculum has been modified from time to time and will certainly be subjected to considerable changes in the near future. At present it extends over a period of five years and two terms. The student must produce evidence of adequate general education. The examination at the University of matriculation, the usual Leaving Certificate Examination of the Department of Public Instruction or matriculation at another approved university are required. In the first year the student devotes his attention to pure science without reference to medical problems. Elementary chemistry, physics, botany and zoology are the subjects. In the second year he takes anatomy, including embryology and histology, physiology, including bio-chemistry, and applied chemistry and pharmacology. In December of the second year the "second degree" examination is held. In the following year the same subjects are continued and in December of that year the "third degree" examination completes the first part of the curriculum. A "post" takes place in March, so that a student who has failed in December, may catch up his comrades at the beginning of the fourth year by working through the summer vacation. The subjects of the fourth year are pathology and bacteriology, medicine, surgery and hospital practice. The student has to attend the classes of the tutors in medicine and surgery and also takes what is known as clinical surgery. During this year a considerable part of the study takes place in the Pathological Department. The subject of pathology is not taught primarily in association with the practice of medicine and surgery. In the fifth year, after the student has passed the "fourth degree" examination, he attends lectures in medicine, surgery, gynæcology, obstetrics, medical jurisprudence and preventive medicine. He takes the classes in *materia medica*, therapeutics and pharmacy. In the last two terms he is required to undergo a course of teaching in diseases of children, diseases of the skin, diseases of the eye, ear, nose and throat and psychiatry. The final examination is held in August. This course is prescribed for the student seeking the degree of Bachelor of Medicine and Bachelor of Surgery.

The fees for the course aggregate approximately £300.

The degrees of Doctor of Medicine and of Master of Surgery may be taken by medical graduates of the University of at least two years' standing. A thesis on some subject selected by the candidate must be submitted and the candidate is examined on the views expressed in his thesis. The fees for these degrees are twenty pounds each.

THE MEDICAL SCHOOL OF THE UNIVERSITY OF MELBOURNE.

Prepared on Special Request by the Dean of the Faculty of Medicine.

A general account of the new curriculum for medical students in the University of Melbourne was given in the Education Number issued on May 6, 1922 (pages 496 and 497). No important change in the course has been made during the past year.

A preliminary examination in chemistry and physics has not been made compulsory, but the following note has been included in the Calendar for 1923: "In the subjects natural philosophy (medical course) and chemistry (medical course) students will be assumed to have a knowledge of mathematics, including the meaning and use of logarithms, elementary algebra, including the solution of equations of the first degree in one variable, the definitions of the simple trigonometrical ratios and the relations between them and circular measure and of physics and chemistry up to the standard of the Intermediate Examination."

The longer period of three months' attendance at a children's hospital and the final clinical examination in diseases of children now come in full force. In the teaching of anæsthetics only three lectures on theory will be given at the University, the introductory lectures on practical methods being transferred to the clinical hospitals. The introduction lectures on venereal diseases, which preface practical instruction, will be placed as early as possible after the completion of Division III. (pathology *et cetera*). The optional course of radiology has proved highly successful one hundred and ten students having attended in 1922.

Under the will of the late Dr. Beattie Smith the University has received £1,000 to provide a few lectures annually on the early stages of insanity. The Matheson Lectures in 1923 on further progress on the subjects of research by the late Dr. G. C. Matheson, will be given by Professor Osborne. The Stewart Lectures of 1922 were delivered by Professor Berry on growth and arrests of growth in the brain.

The new buildings for the School of Anatomy are approaching completion. The room now used as the Museum of Anatomy, measuring 12.2 metres by 23.2 metres, with three adjacent rooms, will become the home of the Medical School Library. The remaining rooms now devoted to anatomy will serve to extend the accommodation for the Departments of Physiology and Pathology. The present quarters of the Library will be absorbed in laboratories for organic chemistry.

A new Nurses' Home and other important extensions have been provided in the Alfred Hospital.

Changes in personnel include the appointment of Dr. Hiller, Dr. Sewell and Dr. Silberberg as additional Stewart Lecturers in Medicine and Dr. Devine, Dr. Victor Hurley and Dr. Zwar as Stewart Lecturers in Surgery. Dr. R. Chambers, Dr. R. Fowler and Dr. A. M. Wilson became Demonstrators in Obstetrics. Dr. J. T. Tait resigned his office as Stewart Lecturer in Pathology and was succeeded by Dr. C. W. Adey and subsequently by Dr. G. R. Cameron. Dr. W. H. J. Moore became Beaney Scholar in Pathology in place of Dr. D. J. Thomas. Professor Osborne has taken leave of absence to visit Europe and America, Dr. W. J. Young being Acting Professor of Physiology during his absence. Dr. C. J. O. Browne succeeded Dr. Chenoweth as Stewart Lecturer on Anatomy and has lately been succeeded by Dr. J. S. Green.

In the Clinical School of the Melbourne Hospital Dr. W. R. Boyd has retired from the post of Physician to In-Patients and has been succeeded by Dr. W. Ostermeyer. Dr. S. W. Patterson has been appointed Physician to Out-Patients and Mr. H. R. Dew Surgeon to Out-Patients. All physicians and surgeons to out-patients now act as clinical

tutors. Dr. L. J. C. Mitchell succeeded Sir James Barrett as Ophthalmologist and Dr. R. R. Wettenhall became Dermatologist in place of Dr. A. W. F. Noyes. At St. Vincent's Hospital, on the lamented death of Dr. A. Lewers, Dr. A. E. R. White was promoted Physician to In-Patients and Dr. J. W. Grieve and Dr. W. J. Newing were appointed Physicians to Out-Patients. Dr. Constance Ellis and Dr. Edith Barrett were recognized as instructors in venereal diseases at the Queen Victoria Hospital for Women.

Dr. K. D. Fairley succeeded Mr. E. H. Derrick as Cancer Research Scholar. Dr. H. F. Maudsley and Dr. C. W. Adey were appointed Clinical Research Scholars. More recently Miss M. Warner, M.B., succeeded Dr. S. O. Cowen in the same capacity.

The annual fees payable by medical students to the University have been increased by two pounds. A fee of one guinea is imposed in respect of every supplementary examination. The entrance fee to any general hospital is increased from ten guineas to fifteen guineas. When the new curriculum comes fully in force, the clinical instruction fees payable to a general hospital will be increased by five guineas in all. The fee payable to the Women's Hospital for midwifery has already been increased from eight guineas to ten guineas and that for attendance at the Children's Hospital from one guinea to five guineas. The fee for the course in diseases of the throat, nose and ear has been raised from one half to one guinea.

THE MEDICAL SCHOOL OF THE UNIVERSITY OF ADELAIDE.

The Medical Faculty of the University of Adelaide, like those of the two other Universities, has had under consideration during the past twelve months the recommendations of the General Medical Council in regard to certain modifications in the medical curriculum. Some changes were effected a little over a year ago and the curriculum at present is practically the same as that of 1922. The main points are repeated in this place, although the details were published in the Education Number of 1922 (May 6, 1922, pages 497 and 498).

The curriculum is now one of six years' duration. Students are admitted to the Medical School after having passed the Higher Public Examination or some equivalent examination. The first year is spent in the study of physics, inorganic chemistry, physical chemistry, botany and zoology. Some attempt is made to adjust the teaching of zoology to medical needs, but in other respects these sciences are taught without reference to their ultimate application in the course. An examination is held at the end of the year. If the student is successful, he passes on to the study of anatomy, histology, physiology, bio-chemistry and organic chemistry and continues these subjects throughout the second and third years. In the third year he also takes *materia medica* and pharmacology, but relinquishes organic chemistry. At the end of the third year the examination in the subjects of the second and third year is held. When he has passed this examination, he begins his clinical work. The subjects of the fourth year are medicine and surgery. Part of the time is spent in the Adelaide Hospital. Lectures are delivered on the principles and practice of medicine and of surgery, on therapeutics, on public health and preventive medicine and on clinical medicine and surgery. The practical work of the fourth year includes a course of bacteriology and pathology and autopsy work. The student also attends a course of lectures on dentistry. Similar work is continued during the fifth year. In addition, the subjects of obstetrics, operative surgery and surgical anatomy are prescribed. The obstetric course includes attendance at systematic lectures and presence at twenty births. Some instruction is given in venereal diseases at the Venereal Diseases Clinic and infective fevers are taken at the Isolation Department of the Adelaide Hospital. The examination at the end of the fifth year is on clinical medicine, clinical surgery, regional and surgical anatomy, operative surgery, therapeutics, pathology and bacteriology and public health and preventive medicine. The sixth year is devoted to instruction in general medicine and surgery, diseases of children, gynæcolgoy, forensic and psychological medicine, diseases of the eye, ear, nose and throat and lastly medical ethics. The student is also required to be taught how to administer anæsthetics. At the end of the sixth year he sits for his final examination.

The fees for the whole course are £180. This includes the examination fees for the degrees of Bachelor of Medicince and Bachelor of Surgery. It does not include the entrance fees, the fees for the courses in practical pathology, in bacteriology and in dispensing. He must provide ten guineas for these. He has also to pay one guinea for instruction in anæsthetics, seven and later ten guineas a year for hospital practice, two guineas for dentistry and two guineas for children's diseases. The total amount is approximately £221.

The degrees of Doctor of Medicine and Master of Surgery can be gained by medical graduates of not less than three years' standing. A thesis must be submitted. The fee for each degree is fifteen guineas.

POST-GRADUATE TRAINING.

Within recent years steps have been taken in Melbourne and Sydney to offer to the medical profession continued instruction in general and special subjects. In Melbourne a committee, known as the Melbourne Permanent Committee for Post-Graduate Work, has been formed. The members of this committee are nominees of the Victorian Branch of the British Medical Association, the University of Melbourne, the Walter and Eliza Hall Institute for Research in Pathology and Medicine and the medical staffs of six metropolitan hospitals. An annual general course is held in November. The attendance at these courses is good. Graduates are offered lectures and demonstrations at the several hospitals on subjects extending over the whole range of medicine. This course is supplemented by shorter courses or series of lectures and demonstrations on special subjects, usually in association with the University course for the Doctor of Medicine degree in special subjects. The fee for the November course is three guineas. The fees for the extra courses vary according to the extent of the organization. A most valuable course was held at the Women's Hospital, Melbourne, in September, 1922, for the assistance of candidates for the M.D. examination in gynæcology and obstetrics. The course was open to all medical graduates as well. The fee for this course was four guineas. The Melbourne Permanent Committee for Post-Graduate Work has been in existence for a sufficiently long period to justify the conclusion that it has established itself firmly and that the plan on which it works is admirable and calculated to yield the best results. The courses are practical and are eminently suited to the requirements of medical practitioners whose medical schooldays lie some distance in the past.

In Sydney the arrangements for the post-graduate courses are left in the hands of the University of Sydney Extension Board. The scheme was evolved by the New South Wales Branch of the British Medical Association in association with the Dean of the Faculty of Medicine of the University of Sydney. The approval of the Faculty and of the Senate was obtained and the matter was referred to the University Extension Board. The courses are held in January and the programmes are very large and comprehensive. At first the organization was defective, probably because the arrangements were in part in the hands of non-medical graduates. The attendance does not appear to be as large as that at the Melbourne courses. The popularity of these courses, however, must increase as medical practitioners realize that the teachers at the Medical School and the members of the staffs of the metropolitan hospitals are sacrificing time and energy in preparing excellent lectures and demonstrations for their colleagues. The fee for the course is three guineas. So far no extra courses or special series of lectures have been planned.

The reorganization of the Australian Institute of Tropical Medicine at Townsville and the appointment of a new Director have been coincident with the arrangements for a course of instruction in tropical hygiene. This course is to be recognized by the Universities of Melbourne and Sydney in connexion with the diplomas in tropical hygiene. A course was to have been held in January, 1923, had a

sufficient number of candidates submitted their names. It is to be hoped that medical practitioners will take advantage of the facilities for post-graduate study of tropical hygiene offered at the Institute.

While the medical graduate in Australia can find practically all he may desire in the way of post-graduate training within the Commonwealth, many practitioners seize the opportunity of a visit to Europe and America to extend their knowledge at the numerous clinics and other institutions in the United Kingdom and in foreign countries. It must be admitted that continued education with new teachers in strange surroundings is always very valuable. The medical practitioner visiting England should apply to Dr. Margaret A. Willis, Secretary of the Fellowship of Medicine, 1, Wimpole Street, London, W.1, for information and assistance. The Fellowship of Medicine has inaugurated The Post-Graduate Association of London, an organization for the coordination of all the post-graduate activities in the metropolis of the world. Information can also be obtained from the Medical Secretary of the British Medical Association. Apart from the regular post-graduate courses, visiting practitioners may desire to obtain degrees or diplomas in special subjects at the universities or corporate bodies recognized for this purpose. In a similar manner information concerning the existing facilities and the formalities to be followed in Scotland and Ireland may be obtained from the Medical Secretary of the British Medical Association.

In almost every foreign country provisions exist for post-graduate study. The usual method followed is for the visiting practitioner to select the clinic at which he desires to work and to ascertain from the chief of that clinic the conditions under which he may undertake work. Medicine is cosmopolitan and Australian medical practitioners will find an open door wherever they may seek admission.

Medical Registration.

The qualifications necessary to secure registration are different in each of the several States of the Commonwealth of Australia. Registration is controlled by State legislation. In Queensland the Act of Parliament dealing with this question and with the methods of dealing with offences is a relic of the past. It dates from 1867. Until such time as the several States are prepared to surrender their sovereign rights in this regard and until the Federal Parliament is prepared to shoulder its responsibilities in medical matters, the status of the medical profession will be on an unsatisfactory basis from the point of view of practitioners themselves and that of the general public. Until this highly necessary change is made it will continue to be obligatory for a medical practitioner to secure registration in each State in which he wishes to practise.

Fees for Registration.

In Victoria a fee of five guineas is required to be paid on making application for registration. An additional fee of five shillings is charged for the registration certificate.

In South Australia there is an annual registration fee of one guinea. Medical practitioners may, however, pay the sum of five guineas either at the time of registration or at a later date as a commutation of all renewal fees.

In Tasmania a registration fee of three guineas is charged.

Qualifications for Registration.

In view of the differences in each State and for the sake of clearness the provisions contained in the six Acts in regard to qualifications are set out in tabular form.

The following persons are entitled to be registered in the respective States:

New South Wales.

(*i.*) Graduates of Australian universities.
(*ii.*) Graduates of universities in the United Kingdom.
(*iii.*) Diplomates of the recognized corporate bodies in the United Kingdom, entitled to registration in the United Kingdom.
(*v.*) Persons entitled to practise in a foreign country which has entered into reciprocal arrangements with Australia in this regard; provided that they have passed through a course of study of not less than five years' duration.
(*iv.*) Persons who are or have been appointed medical officers in His Majesty's set or land services.
(*vi.*) Persons who have passed through a course of study of not less than five years' duration in a foreign country and are entitled to practise in that country and who pass an examination prescribed by the Senate of the University of Sydney.

No person who is a German or Austrian subject or who possesses a German or an Austrian degree only, can be registered.

Victoria.

(*i.*) Graduates of the Australian universities.
(*ii.*) Persons who have passed through a course of study of not less than five years' duration in a British university, college or body, or in any foreign university, college or body recognized in that country and who possess a diploma or degree entitling them to practise in that country, provided that the same arrangements obtain in that country for graduates of the University of Melbourne.
(*iii.*) One person holding the qualifications of the Boston Homœopathic University and College or of the New York Homœopathic Medical College and Hospital may be registered each year.

Queensland.

(*i.*) Graduates of the Australian universities.
(*ii.*) Persons who have passed through a course of study of three years' duration, who have passed the examination prescribed in the country in which they have studied and who are entitled to registration in that country.
(*iii.*) Persons who are or have been duly appointed medical officers in His Majesty's sea or land services.

South Australia.

(*i.*) Graduates of a university in Australia or New Zealand.
(*ii.*) Persons registered or entitled to be registered in the United Kingdom.
(*iii.*) Persons who have passed through a course of study of five years' duration in a foreign country, provided that the standard is not lower than that recognized in South Australia, and who have received a degree or diploma and are entitled to be registered in that country, provided that equal rights are granted in that country to persons registered under the South Australian Act.

Western Australia.

(*i.*) Graduates of the universities of Australia.
(*ii.*) Persons entitled to registration in the United Kingdom.
(*iii.*) Graduates of British or foreign universities who have passed through a course of study of not less than three years' duration.

Tasmania.

(*i.*) Graduates of all British universities.
(*ii.*) Persons entitled to be registered in the United Kingdom.
(*iii.*) Persons who are medical officers in His Majesty's sea or land services.
(*iv.*) Graduates of a medical college of Class "A" in one of the States of America, provided that they have passed through a course of study of four years' duration and have received a degree or diploma from that college and provided that they hold a certificate or licence entitling them to practise in one of the States of America.

Statistics of the Medical Profession.

During the year 1922 a laudable attempt has been made to render the official Medical Registers in the six States of the Commonwealth more reliable guides to the membership of the medical profession. It appears that in Victoria the expedient has been adopted of circularizing medical

practitioners registered in the State and removing the names of those who do not respond. Over one hundred and fifty names have disappeared from the list as a result of this inquiry. Not all refer to practitioners whose last known addresses were within the State. The total number of medical practitioners with addresses in Australia whose names appear in the Registers for 1923, is 4,125. It is obvious that this figure cannot be compared with the corresponding number in the 1922 Registers, since the number of inaccuracies has been considerably reduced. During the year 1922 no less than three hundred and sixty-four practitioners were registered for the first time in one or other State, but even this figure is open to objection, since many of these practitioners have moved from one State to another and their names appear for the first time in the Registers of the States to which they have migrated.

The Medical Register of New South Wales contains the names of 1,625 medical practitioners resident within the State. Of these, twenty-three are resident in Broken Hill. In addition, there are three practitioners without addresses, attached to the Royal Navy. The number is too high. In several instances the addresses given are known to be incorrect. Allowance has also to be made for those who have retired from medical work of all description. Compared with the list for 1922, there appears to be a net increase of eighty names. There were one hundred and thirty-two new registrations. The net increase in the medical population would seem to be about 5½%. The increase in general population was about 2% during the year 1922. No doubt the increase in specialism accounts for the need for a relatively larger number of doctors.

In Victoria the number of names of medical practitioners residing in the State in the Medical Register for 1923 is 1,452. It is impossible to calculate from the Registers the increment during the year 1922, since so many names have been removed on account of previous error and other causes. There have been one hundred and two new registrations and twelve deaths. On this basis it would seem that the increment was ninety. This would represent approximately over 7% increase on the estimate made in these columns last year. The increase in general population for the year worked out at 2.55%.

The first part of the Medical Register of Queensland is reserved for practitioners resident at the time of compilation in the State. In the 1923 edition there are four hundred and thirty-eight names in this part. This represents an increase of twenty-four on the previous year's list. In 1922 fifty-four new registrations were effected. The increment represents practically 5.8%. The increase of general population was about 2.6%.

The Medical Register of South Australia is divided into four parts. The first part contains names of practitioners who were registered prior to the *Medical Practitioners Act of 1919*. The second part contains the names of practitioners registered under the 1919 Act (continuous registration); the third part contains names of those registered under the same Act under the clauses for annual or provisional registration. The fourth part contains names of practitioners registered in South Australia, but not resident at the time in the State. The 1923 Register contains the names of three hundred and sixty-eight practitioners resident in the State, while there are five resident in Broken Hill. In fifteen instances no address is given. The year's increase appears to be thirty. There were thirty-six new registrations. The increment represents 9.1% of the number practising at the beginning of 1922. The increase of general population in 1922 was 2.1%.

The Western Australian Medical Register for 1923 contains the names of two hundred and eleven practitioners. One has to be deducted, because the registration was effected in January, 1923. This represents an increase of eight for the year. Strange to relate, there were no less than twenty-two practitioners registered during the year 1922. The increase for the year is 4%, while the increase in the general population was 3.2%.

According to the Medical Register, Tasmania has one hundred and forty-nine medical practitioners resident in the State. There were eighteen practitioners registered during 1922. The increase appears to be nine, which is equivalent to 6.3%. The increase in the general population was 3.6%.

Medical Students' Societies.

Youthful optimism is probably the dominant quality of the medical "fresher." Care-free and somewhat happy-go-lucky, he delves into the hidden mysteries of snails, frogs and sting-rays with a zest that is only equalled by his desire to produce new "stinks" in the chemical laboratory. Freed from the irksomeness of school restraint, he can take his pleasures and his sport at will and the percentage concentration of these in the sum total of university life is a variable quantity. On the judicious admixture of work, sport and social intercourse will depend his future outlook on life. The plight of an apparently successful practitioner seated in the armchair of a middle-aged cynicism, his "fair round belly with good capon lin'd" and with no active connexion either with his fellow practitioner or with medicine as a science, is indeed a sorry one. Such a fate does not await the man who is prepared to give of his best to his *confrères* and by rubbing shoulders with them to learn from their experience something that will "leaven the whole lump" of what might otherwise be a doughy existence. In this regard the claims of the medical students' societies have been repeatedly urged in the Education Number of The Medical Journal of Australia.

While membership of these societies is not compulsory for every student, it is essential for all who would realize their ambition and make adequate use of their opportunities. The medical society habit is one which grows and, directed along proper channels, it cannot fail to subserve a useful end. A medical society for students exists in each of the three Australian Medical Schools.

The Sydney University Medical Society was founded in 1886 by the late Thomas Anderson Stuart. This great teacher recognized that it was necessary to have some meeting ground for students and teachers other than the class-room and that a well-organized society would help in the development of medical knowledge. Membership is open to all graduates and undergraduates of the Sydney University and to any practitioner whose medical qualifications are recognized by the University. The subscription is seven shillings and sixpence *per annum* for senior undergraduates and five shillings for junior undergraduates. Graduates may become life members for the payment of one guinea and by paying another guinea they insure receipt by them of the Society's journal for four years. *The Sydney University Medical Journal* is published twice a year. It is a comely and well produced journal. As the years go on its succeeding editors endeavour to maintain a standard of respectability that is very becoming in such a dignified body.

The Medical Society of the University of Melbourne endeavours to act up to its past reputation. It was founded "to foster a more cordial understanding and a closer relationship between medical students and to advance their knowledge and further their interests generally." According to its constitution the President and the Vice-President are required to be members of the Victorian Branch of the British Medical Association. The subscription to the Society is five shillings. Any member of the Society or qualified practitioner who pays the sum of five guineas, may be enrolled as a life member by a vote of the members at the annual meeting. Members of the Society receive a copy of *The Speculum*, a journal which it is understood was formerly read in secret by the heads of colleges and members of the Senate. Some individuals have expressed the lively hope that the interest of the "heads" will be reawakened in this literary effort. *The Speculum* is an admirable journal that does much to foster a feeling of affection for the *alma mater*.

The Adelaide Medical Students' Society was founded in 1889 in order "to further the interests of medical work amongst students and to provide intercourse amongst its members." In addition to undergraduate members, provision is made for membership of graduates of the University of Adelaide and of any recognized university. The subscription is five shillings *per annum* for graduates and ten for undergraduates. Three guineas is the amount necessary to secure life membership. *The Adelaide Medical Students' Review* is the official organ of the Society. It is a delightful publication and fulfils admirably its purpose.